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HISTORY OF ECOLOGY AND ENVIRONMENT: INDIA

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Subject: HISTORY OF ECOLOGY AND ENVIRONMENT: INDIA **Credits: 4**

SYLLABUS

Studying Ecology & Environment: An Introduction
Sources of Study, Indian Landscape, Nature-Human Interface

Environment, Early Societies and Agricultural Societies
Nomadic Pastoralism, Hunting-Gathering, Resource Use and Human Societies, Agricultural Diffusion and Regional Specificities-II, Agricultural Diffusion and Regional Specificities-I, River Valley Civilization, Origins of Agriculture

Appropriation of Environment & Indian Philosophy
Metal & Mineral Resources, Forest Resources, Water Resources, Energy Resources, Transitions, Conservation Through Ages, Man-Nature Relationship

Colonialism, Environment and Modern Concerns
Resource Management: Water, Resource Management: Forests, Environmental Agenda, Understanding of Environment, Alternatives, Environmental Resources and Patents, Biodiversity, Development and Environmental Concerns

Suggested Reading:

1. Nature's Economy: A History of Ecological Ideas by Donald Worster, Alfred W. Crosby

2. Visions of the Everglades: History Ecology Preservation :by Tommy Rodriguez

3. An Ecological History of India : Madhav Gadgil (Author), Ramachandra Guha (Author)

Chapter 1
Studying Ecology and Environment: An Introduction

STRUCTURE

- Learning objectives
- Nature-human interface
- Indian landscape
- Sources of study
- Review questions

LEARNING OBJECTIVES

After reading this chapter, you should be able to:

- Understand the nature.
- Describe the nature-human interface.
- Describe the physical features.
- Understand the landscape perceptions

NATURE-HUMAN INTERFACE

Defining Nature

Nature is not an easy term to describe as it incorporates mainly 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 spaces', as also 'plants and creatures other than man.'. Surely the common 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, therefore, nature and environment convey almost the similar meaning. In exploring human-nature/environment connection we consider the natural circumstances and powers that affect and sometimes determine the actions of human groups. In excess of an extensive era of time in history this connection operates at two dissimilar stages; at one stage it wields power as a widespread ongoing

procedure, and at the other it acquires the form of the connection of specific human groups to their "immediate environments". For our purpose we do not especially favor any one of the two and give a narrative that tends to draw information from both as the situation demands.

In the case of the Indian sub-continent an extremely wide range of climatic and topographic situations prevail to power the environment. As a result a delicate balance is maintained flanked by extreme environmental circumstances which is comparatively easily disturbed and we experience varying degrees of uncertainties extending in excess of 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.

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 information an understanding in relation to the procedure of development of humankind is more significant to us as it helps us grasp the simultaneous development of man-nature connection.

Till recently, up to the post-enlightenment period, the concept of a divine origin of nature and humans had been in prevalence. The human beings were also subject to an evolutionary procedure was a theme strengthened through the theory first proposed through Charles Darwin. In his job *The Origins of Species*, Darwin argued that dissimilar species had undergone to procedure of development and this development was the result of minor variations in the features of the individual members of species. These features were inherited through the successive generations and as a result of this extensive sequence of inheritance new species were able to evolve and emerge distinctively. Darwin also proposed that the adaptive capability of species influenced the chances of their survival and he termed it as the procedure of the 'survival of the fittest'. The evolutionary model had made another significant contribution towards our understanding of man as a 'unique

animal', an animal who could adapt to dissimilar natural circumstances and mainly importantly could vary the nature/environment for its survival.

The procedure of human version to environmental circumstances was accompanied foremost through the introduction of apparatus and their use through the primitive man. The significance of apparatus in the study of the development of humankind can be realized from the information that this whole procedure has been classified in conditions of the excellence of apparatus and the nature and excellence of the material used in creation the apparatus. Therefore the earliest era in human history, also described pre-history, has been termed as Paleolithic. This was followed through Mesolithic, Neolithic, Chalcolithic, Iron Age, and so on. For the convenience of also accounting for implements other than apparatus, we term this procedure as the development of artifacts and begin our investigation of man's connection with nature throughout this significant stage of human action.

A Maker of Artefacts

The human beings are endowed through nature to be reflective and active. Their biological development has given them the capability to set up adaptive connection with nature. Though, we can only be speculative in relation to the factors and adaptive impetus responsible for the development of human skill to forge artefacts. Indeed this skill necessity have evolved in excess of a extremely extensive era of time and would have begun with the local materials that were easily available and were suited to serve the purposes planned through the objects.

We know from archaeology that the first artefacts made through humans were of stone and had made their appearance more than two million years ago. This had marked the beginning of the Palaeolithic Civilization. It was an extra ordinary occurrence and showed "a high stage 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 approximately". Like other animals, the initial mode of sustenance for humans was hunting and gathering. Mainly of these artefacts were made with the objective of assisting them in

their quest for food, hunting, and gathering. Stone apparatus were used primarily for cutting plants, digging root crops, scrapping wood and obtaining honey. There were two broad groups of stone apparatus for the era: 'core' apparatus and 'flake' apparatus. Core apparatus were those apparatus which were made from the superior blocks of stone. Flake apparatus were those apparatus which were made from the little bits or flakes which would approach off a block of stone when it was hit almost certainly for creation core apparatus. The mainly significant core tool was hand-axe. Hand-axes were basically used for processing of meat and did reflect great physical dexterity. In the creation of the stone apparatus here was a definite proof of the beginning of man's effort to adapt to the nature through applying his mind and creation use of in the vicinity available material for better functioning.

The appropriation of natural circumstances was still confined to the mainly rudimentary stage, yet the act was extremely important for it heralded the procedure of modification of natural circumstances for better management of natural possessions. The Palaeolithic growths were followed through the growth of microlithic apparatus and this stage is termed as Mesolithic Civilization. We are now witness to a greater manages of man in excess of the tool-creation industry as the apparatus now become lighter and more efficient. In addition to stone we now discover more diversity in the use of materials for creation microliths. Bone, animal horn, bamboo, and wood make an appearance. The excellence of artefacts produced throughout this era is suggestive of an improved technological competence. It is logical to assume that such competence would also have helped grow many other skills of working on materials other than stone e.g., wood, bamboo etc. The knowledge of by fire for clearing grasslands and forests beside with these additional skills was a definite advance in excess of the previous stage in so distant as the management of natural possessions was concerned.

It is approximately this time that early rock art specimens become available. An analysis of the depictions made in these specimens brings out the information that the humans had through this time become acutely aware of the animal world and had begun to illustrate signs of seeking refuge, even if temporarily under rock shelters, mounds and other natural locations. This

should be measured an important development in nature-human interface. Here was the beginning of the procedure of domesticating animals and utilizing their power in the service of the mankind.

We necessity draw a word of caution here before the approximately euphoric feelings at having supervised nature in an efficient manner than the preceding Palaeolithic stage leads us astray. The information was that in spite of these growths the humans were even now at the mercy of their immediate environment and were "in a extremely real sense dominated" through it. What appears closer to reality is a situation that exhibits, on the part of the human groups, a conscious awareness of the environment based on a secure connection with the environment. This connection was fostered through behaviors 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; perhaps also burning grasslands and forests to facilitate their hunting behaviors or improve the grazing for their favored food animals".

Social Animal

The connection flanked by 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 managed in excess of these sources. A significant contribution of agriculture has been the farming of cereals. The information that the shelf-life of cereals is extremely extensive whereas fruits and meat have a limited shelf-life necessity has added immensely to human capabilities. It is also important to note that this property of cereals encouraged accumulation which was one of the principal causes for social stratification to emerge and with it an intricate civilization to emerge with several dissimilar societies existing within and interacting with each other.

In the initial stage the agriculture was highly unreliable and as a regular source of food did not meet the demands of man. In information transition from the hunter-gatherer stage to the agriculture stage was an extensive drawn procedure. The development of technology/apparatus to augment the manufacture was also a gradual procedure and it was only after

the development of irrigation technology that agriculture acquired a key role in food manufacture. Initially the agriculture was confined to highly favorable sites with natural irrigation. With the growth of population, though, man was forced to migrate to less-favorable sites necessitating the development of irrigation facilities that demanded superior social participation and better skills of management.

Food security and greater manage in excess of agriculture enabled man to have some spare time as agriculture had been a seasonal action. At the similar time demand for better apparatus for agriculture and technology for irrigation to ensure greater manufacture as well as a relative shortage of raw material for apparatus forced man to seem for other sources/ types of materials. This gave rise to the use of metals and their extraction through metallurgy. With the beginning of metallurgy therefore, a new stage of development was attained. The detection of metallic ores once again liberated man from the dependence in excess of nature. The major advantage of metal apparatus in excess of stone was their reusable character: stone apparatus once broken could not be used again whereas metal apparatus could be remolded. Though, relative scarcity of ores jointly with the possessions needed in processing the ores, right from procurement to transportation and extraction, made the creation of metal apparatus a labor rigorous and in several ways an expensive proposition. A significant feature of metallurgy had been the requirement of highly specialized knowledge and expertise therefore creation it a full-time job. Such specialists could be sustained with the help of the available agricultural surplus. In this procedure we clearly see the emergence of a part of population that was not directly involved with the procedure of food manufacture, yet was able to sustain itself on the labor produce of others. The “parasitic” character of this part of population had in information given rise to the possibility of sustaining solely on the foundation of the acquisition of special skills without having to participate directly in the procedure of agricultural manufacture.

The character of the agriculture based civilizations could now be defined in conditions of intricate social formations having stratified social and occupational groups within. The rising skill to manage the nature for social

requires allowed agricultural civilizations to start systematic use of natural possessions for the benefit of the superior society giving, in turn, rise to socio-politico-economic hierarchies. In this procedure 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 civilizations was a gradual and steady procedure indicating man's manage in excess of nature, there were still numerous instances of the vagaries of immediate environments affecting this growth and therefore creating troughs and peaks in the graph of agricultural development in lay of an imagined smooth row only indicating uniformly onward march. The few archaeological sties that have been investigated in detail yield motivating information. The earliest location is at Mehrgarh situated on the Bolan River in Baluchistan. The down-cutting and lateral movements of the distributaries of Bolan are perhaps "the outcome of the natural instability of the region" and "due to pressure on the environment caused through human behaviors such as harvesting grain, collecting firewood, felling trees and herding animals in the immediate locality and in the mountainous regions that form the head waters of the Bolan river". Approximately alike is the case of the municipalities of the Indus civilization. It is usually accepted that the region has not seen any major shift in the climatic circumstances since the emergence of Indus civilization. Yet "proof of an era of somewhat increased humidity coinciding almost with the high urban stage of the Indus municipalities" has also been noted. A point of great significance here is that the return to rather more arid circumstances, like the present, appears to coincide almost with the collapse of Mohenjo Daro, and apparently also with the failure of the wider infrastructure of the Indus urban world".

Nature-Human Interface: Changing Concerns

We have hitherto been describing the nature-human interface in the context of human version to the limits determined through the nature. Till the advent of agriculture the connection flanked by man and nature was highly tilted in favor of nature, where man was mostly the recipient of the

benevolence of the nature. Apparatus of the lithic ages-Paleolithic, Mesolithic, or Neolithic were basically instruments of facilitation towards the benevolence of nature. Man had to manage with the survival offered through the nature and could do little to power the procedures or patterns of nature. The survival pattern of this age was termed as 'hunters and gatherers' and life-approach was itinerant. The civilization was moving from easy social structure to intricate social structure slowly. A fully manifest intricate social structure appeared with the advent of agriculture that helped generate surplus and began the procedure of urbanization. Up to this time the connection flanked by man and nature was to a considerable extent determined through the harshness/benevolence of nature to existing stages of technology.

A qualitative and epoch-creation shift in the nature-human interface became apparent with the onset of industrial age. The stage of technology of industrial age liberated man from physical labour and introduced the use of a biotic sources of energy that replaced human and animal energy. Since ancient past thermal energy had been used in direct applications, but throughout industrial age it was used to mechanize apparatus. Industrial age introduced the conversion of thermal energy to mechanical energy, hence expanded the possibilities of its use. The ever rising demands had also led to the search for newer shapes of energy and to the detection 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 nonrenewable sources of energy redefined the connection flanked by nature and man and the concept of the conservation of natural possessions came into subsistence.

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

Another region where a major impact had occurred due to an extensive use of energy was that of agricultural manufacture. Increased productivity and

food security slowly led to a sizeable augment in population. Due to extension of farming and population there was now a major strain on forests and other natural possessions. It was not that human civilization 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 describe it in conditions of an ecological watershed, i.e., the end of a natural regime that was determined through the features of pre-industrial civilizations. "What was shattered" wrote Braudel, "with the eighteenth century was a biological 'ancient regime', a set of restrictions, obstacles, structures, proportions, and numerical relationships that had hitherto been the norm". The connection of harmony and a tacit coexistence with nature now gave method to human endeavour to totally harness and use natural possessions.

The ever-rising mechanization of even the day-to-day behaviors increased the demand for energy to new heights. An approximately reckless use of energy sources of the fossilized form and blind growth of industries of all types gave rise to troubles of environmental pollution. We are today faced with serious environmental threats like the 'green home 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 urbanized an artificial material which was not biodegradable, therefore hard to destroy and decompose. At the similar time, the wider applications of the material at industrial and domestic front at low cost of manufacture encouraged its wider circulation. Likewise, the question of the viability of nuclear fuel as a source of energy has been a major issue of debate. The manufacture of non-natural radioactive substance for energy manufacture 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 just as due importance to the role of new technologies in the portrayal of a comprehensive picture of human-environment interface, we necessity not neglect the socio-political thoughts. Until 1700, the rights and rewards of use of the natural world lay mainly 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 civilization throughout mainly western civilizations. The legitimate rights of use of nature were now extended to individuals at big in civilization. The 1800s were the culmination of an era of worldwide spread of western civilization through colonialism and establishment of world deal. The western organization of environmental use was therefore spread widely, so that it became the operational organization even in regions where the vital philosophical view of human and nature was quite dissimilar.

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

These are the few concerns that tend to redefine nature – human interface. We, though, cannot afford to remain insular to these growths in the name of preserving a pristine man-nature connection. We necessity be open to new perspectives in our understanding of civilization and scientific growths. Daniel B. Botkin says that 'We necessity distinguish flanked by merely the persistence of some types of life and the maintenance of a biosphere that is desirable to human beings', inherent in it is his vital question that nature is not constant and even the change is not constant, therefore the only method to interact with nature is to enlarge our understanding of environment and its functioning at the similar time to realize the limitations of human capabilities to manage nature just as to his wishes.

INDIAN LANDSCAPE

Physical Features

A detailed account of the physical features of India will enable you to understand better the visible differences in the topography of the dissimilar parts of the country. It will also help you see the underlying environmental factors that also determine the connection flanked by the physical geography of any region and its resolution patterns. The site and expanse of India's landforms have played an important role in influencing her past history. Since associated features such as climate, land-use, means of transportation, sharing of population, etc. directly relate to history the study of physical features in relation to man and his requires is vital. India can be divided into the following four major physiographic divisions:

- A high mountain barrier shaped through 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 recognized as the Indian Plateau; and
- The Coastal Lowlands fringing the Plateau of Peninsular India.

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

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 a region of almost 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 shapes which develop when strata is intensely folded. Though, intermontane plateaus and big-sized basins are conspicuously absent in these intensely folded mountains. The Vale of Kashmir, in relation to the 135 km. extensive and 40 km. broad, is the only big stage strip of land in the Himalayas. In common, the Himalayas consist of three main ranges – the Siwalik Range beside the southern margin, the Great Himalaya beside the Tibetan border and in flanked by these two is the Lesser Himalaya. Additionally there is a range in the east recognized 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 almost 50 km. in the west, it narrows slowly towards east and loses its identity in the Bengal Duars. The height of these ridges usually does not exceed 1,220 meters. Mainly of these ridges had shaped after the formation of the Himalayas, therefore they obstructed the courses of the rivers draining to the south and west and created temporary lakes in which debris brought through those rivers was deposited. As the rivers had cut their courses through the Siwalik Range, the lakes were drained leaving behind plains described Duns. One such plain shaped as a result of the draining of lakes is Dehra Dun in Uttaranchal.

The Lesser Himalaya

These ranges rise north of the Siwalik Range and being deeply cut through rivers are highly rugged and ill defined. They are more clearly defined in their expanse towards west where they are recognized as the Dhaola Dhar, the Pir Panjal, and Nag Tiba. The Mahabharat Range and the Mussorie Range

are two other ranges of the Lesser Himalaya that run as continuous ranges for extensive distances. These ranges vary a lot in height but are usually less than 3050 meters above sea level. Some of their peaks rise to heights of even more than 4570 meters particularly branches closer to the Great Himalaya and are also recognized as Himachal. The Lesser Himalaya is in relation to the 80 km. in breadth.

The Great Himalaya

Also recognized as *Himadri*, it is the longest continuous range in the middle of the Himalayas. It is also the highest range in the world with an average height of 6100 meters. The top of this range, in relation to the 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) secure to the Brahmaputra in Tibet (Brahmaputra is recognized as the Dihang, in this part of the Himalayas). The Great Himalaya is snow-bound throughout the year and makes glaciers which descend to a height of 2440 meters above the sea-stage in Jammu and Kashmir and in relation to the 3960 metres in the east. At their lowest limits, glaciers melt and ensure continuous supply of water to the rivers of North India. Throughout early summer when there is no rain in the plains, the water in these rivers has a scrupulous significance as it is tapped for irrigating the parched land throughout the arid months.

Being snowbound for superior part of the year, this range is forbidding and can be crossed only through a few passes. These passes also become inaccessible throughout winters when the range is snow-bound. Journey through these passes is hazardous and strenuous as they are usually higher than 4570 metres above sea-stage. Pack animals like mules, yaks, and goats were used earlier in the absence of metalled roads for carrying goods crossways 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 flanked by India and Tibet (China).In addition to its being an insurmountable barrier, this range shuts off approximately totally the icy cold-winds of inner Asia in winter and confines, again on explanation 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 described 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-sheltered throughout the year like the Great Himalaya, protects India from the extremely arid winds of Central Asia.

The Eastern Highlands

These mountains consist of hill ranges which pass through the northeastern state of Arunachal Pradesh and run in north-south direction in the form of a crescent. To the north lies a high mountainous land described the Dapha Bum (highest point 4578 metres). From the southern end of the Dapha Bum starts the Patkai Bum. It shapes the international boundary flanked by India and Burma for some aloofness 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 flanked by India and Burma. Further south, this mountainous belt is described the Manipur Hills (usually 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 urbanized a special drainage pattern recognized as trellised drainage. Basically speaking it is a kind of multi-channel drainage which criss-cross to

form a lattice pattern. The ranges and the valleys run usually in north-south direction. They are sheltered with thick forests and are hard to cross. Passes are extremely few.

The sources of the three significant rivers of India, namely, the Brahmaputra, the Sultej and the Indus have their sources close to 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 in relation to the 1.5 km. higher than the stage of the river sources is cut crossways through these rivers to form extremely deep narrow gorges. Just as 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 established in the course of the Indus where it crosses the Himalayas close to 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 totally cut back their courses in the Great Himalaya and have therefore shaped extremely deep gorges. These rivers, for some aloofness, run parallel to the mountain ranges before they descend on the Plains of Northern India. Beside the river courses at some spaces river terraces, which illustrate that the uplift of the Himalayas at intervals has rejuvenated the rivers?

The Plains of Northern India

These plains stretch in the east-west direction flanked by 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 mainly a plain is also incorporated 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 in relation to the 650,000 square km., these are amongst the main plains of the

world and them explanation for one-fifth of the region of India. These are primarily stage plains without any interruption except for a few outliers of the Aravalli Range. The mainly prominent of these outliers can be seen in the vicinity of Delhi. They form in accessible low hills or ridges and emerge out of the nearby alluvium as islands. This region was formerly a deep trench, six to eight km. in depth, which was shaped as a fore deep when the Himalayas rose as fold-mountains. Uniformity in the stage of these plains is mainly due to two facts:

- Authentication took lay in water and
- No earth movement disturbed their flatness later.

In the drier parts of the western fringe of Haryana and neighboring parts of Rajasthan, authentication of windblown dust accounts, to some extent, for the formation of these stage plains. Numerous ravines turning the fertile alluvial land into unusable lands break the southern fringe of the Ganga Plain, particularly flanked by the Chambal and the Son.

The courses of the rivers in these plains make many 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. Beside with canal irrigation, hydroelectric power has also been urbanized for power supply to industries and for domestic use. The rivers are liable to sudden and disastrous floods throughout the rainy season. Owing to flatness of the plains and big loops of meanders, the rivers are sluggish and fail to carry absent water quickly after heavy continuous rain, which leads to a situation of severe and sudden floods. In some regions of high water-table, the flood waters may stand for a few months and therefore impede the sowing of rabi crops. In winter, the volume of water is so little that the rivers appear misfits.

The Indian Plateau

It is also described the Plateau of Peninsular India as it stretches south of the alluvial Plains of Northern India. It looks like a big triangle with its apex in the south at Kanya Kumari. It is distant older than the Himalayan

mountain ranges and is shaped 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 beside which some regions sank forming faulted basins or rift valleys. This occurred sometime throughout the Gondwana era when drainage of the adjoining region flowed into these basins, deposited sandstones, clays and shales (finely stratified stone) which subsequently turned into sinking of the basins, and shaped the coal beds and lay preserved. The valleys of the Damodar, the Mahanadi, and the Godavari roughly spot the location of the Gondwana region. The Narmada and the Tapti valleys leading to the Arabian Sea are rift valleys shaped extensive after the Gondwana era. The Narmada Rift valley continues to the north-east and is occupied through 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 shaped through horizontally bedded sandstones, limestones and shales laid down throughout the pre-Gondwana era. It is suggested that throughout this period the Malwa Plateau was submerged under the sea.

South of the Satpura Range, the peninsula is described the Deccan Plateau. It is whispered that big-level volcanic eruptions took lay in the Cretaeous era which spread distant and wide in excess of the Indian Plateau covering totally the land shapes existing at that time. Repeated flows of melted basalt from fissures built up a basaltic plateau. The basalt so deposited has, though, been eroded absent through rivers from a big region and is visible only in Maharashtra, southern Malwa Plateau and big parts of Kathiawar and covers a region of 520,000 square km. at present.

The Aravalli Range

It runs in the northeast-southwest direction from Delhi to the northeastern fringe of Gujarat State. Flanked by Delhi and Ajmer, it can be characterized through a chain of detached and discontinuous ridges running also in the northeast-southwest direction and shapes basins of inland drainage

here and there. The range is approximately 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 through a steep sided escarpment (extensive steep face of plateau) shaped due to attendance of the Malwa Plateau. This escarpment, measured wrongly as a mountain sometimes, is recognized as the Vindhya Range and runs roughly north-eastwards beside the northern fringe of the Narmada-Son for in relation to the 1200 km. The height of the escarpment usually averages less than 610 metres. The western part of this range is sheltered with lava. The eastern part of this range, not sheltered with lava, is recognized as the Kaimur Hills.

The Satpura Range

It starts from the West Coastal Plain and runs eastwards flanked by the Narmada and the Tapti-Purna rivers and continue up to Amarkantak covering in relation to the 900 kms. Its western extremity is recognized as the Rajpipla Hills and the easternmost part as the Amarkantak Plateau and in the middle we can discover 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 recognized as the Maikala Range overlooks the Chhattisgarh Plain. Dhupgarh close to 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 sheltered mostly with thick layers of basalt. It has two significant gaps; one can be reached through the Bhusawal Khandwa rail part and the other can be reached through Jabalpur Balaghat rail part.

The Chhattisgarh Plain

It is a basin drained through 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 almost horizontal beds of limestone and shales and is enclosed through hills or plateaus. It is a big region measuring in relation to the 73,000 square km.

The Chota Nagpur Plateau

It lies to the east of the Rihand. It comprises 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 beside with the Rajmahal Hills in the north-east constitutes significant physiographic sections of the Chota Nagpur Plateau. In the similar region, the Ranchi Plateau lies to the south of the Damodar. It is in information a group of plateaus elevated to dissimilar heights. The surface of the plateau, which is mostly rolling, is occasionally interrupted through 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 shapes a rectangular block recognized as the Shillong Plateau or the Meghalaya Plateau. The western part of this plateau is described the Garo Hills whereas the central part is recognized as Khasi-Jaintia Hills and the eastern part as Mikir Hills. The central part of the Khasi Hills is a table-land and Shillong city 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 recognized as the Ajanta Range, which again is shaped of basalt and has an appearance, at the top, of that of a plateau?

The eastern face of the Indian Plateau is bounded through the hills described the Eastern Ghats. Many 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 flanked by the Penner and the Krishna and Bastar-Orissa Highlands flanked by the Mahanadi and the Godavari are prominent blocks of the region. South of the Krishna, height of the Eastern Ghats is usually less but north of the Godavari, it is higher and rises to 1680 metres close to Vishakhapatnam district. Mahendra Giri in Orissa with the height of 1501 metres is the second highest point. The Deccan is fringed in the west through the Western Ghats also recognized 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 flanked by them. These highlands form extensive 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 described the Ajanta Range whereas one lying flanked by the Bhima-tributary of the Krishna, and the upper Godavari is described the Balaghat Range. These ranges give in flanked by, broad valley plains extending in relation to the 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 dissimilar minerals) and separated from the Nilgiri through a gap described 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-stage are the highest in South India. These hills end approximately abruptly in the Plains on either face.

The Coastal Lowlands

The Plateau of Peninsular India is fringed with narrow coastal lowlands. Raised beaches and wave-cut platforms above the high water spot signify that these lowlands are essentially the appeared floors of the seas adjacent to the land. After the emergence of these lowlands, fluctuations in sea level, though limited to little regions, have brought some changes in the common surface features of the littoral (shore regions).

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 vast desolate lowland it was shaped due to the

authentication of silt brought mainly through the Indus in the past. Its surface is only slightly above sea level and is interspersed with mudflats, marshes, and creeks. It is sheltered with shallow water throughout the rainy season and is being continuously filled up through the silt brought through the rivers. There are a few islands in the Rann, with Bela, Khadir, and Pachham islands as the only ones of important size.

Kutch, once an island, lies to the south of the Rann of Kutch. It is an arid region with usually broad sandy terrain beside the coast and the Rann of Kutch and bare low rocky ridges in the interior. Kathiawar is situated 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 linked 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 through Lake Nal and Marshes.

Beside with many little rivers, extensive 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 approximately 50 km, which occasionally broadens through a few kilometers at spaces where streams have gnawed back into the steeply rising Western Ghats. Flanked by Daman and Goa the western littoral is described the Konkan. Coastal lowlands of Goa and the Konkan, to the south of Bombay are marked with the low hills separated through river courses which form creeks close to the sea. The information that the drowning of the lower courses of the rivers has taken lay clearly suggests that there has been some recent submergence, though on a little-level, 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

recognized as Kayals. These lagoons receive water of a big number of rivers before discharging that to the sea with which they are linked through narrow openings. Formation of lagoons and off-shore bars indicate that there has been a slight emergence of southern coastal plain not in the extremely distant past. The West coastal lowland south of Surat is drained through many little rivers, which become torrents throughout the monsoon. In the normal course these torrents should have shaped deltas. Though, 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 desalted and thereby impede the formation of deltas on the west coast.

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 spaces 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 in excess of approximately whole of this plain and have built big deltas at many spaces. Sea waves being distant less furious than those impinging on the west coast, the sediments brought through big rivers – the Mahanadi, the Godavari, the Krishna and the Kaveri have shaped deltas. These deltas being fertile and properly irrigated are densely peopled. At some spaces spits, lagoons and off-shore bars have also urbanized beside the coast. The coast is fringed at some spaces with dunes. Mangrove forests grown beside the seaward front of the deltas have been a major feature. As the sea is shallow close to the appeared lowland coasts, deep natural harbors except for Bombay and Marmagao are absent beside both the coasts.

Vegetation

The Indian sub-continent has been witness to an extremely extensive era of human action. Throughout the course of this action the vegetation cover present in the earliest time has been considerably customized. As a matter of information, little trace of this vegetation except for 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 mainly definitely be struck through the information that it essentially was a tree vegetation or forest cover. In excess of many millennia of human action involving clearance and degradation of this forest cover, today only in relation to the one fifth of the total region of India is regarded as under the forest, treated as the protected forest. Half of the protected forest region has been designated as the reserved forest where all types of degrading action are prohibited. In any case the least degenerated forests in India have to be establishing in the Himalayan region and one of the chief causes for their preservation is the inaccessible terrain.

The situation described above was not the similar in historical past. There is proof to suggest that central Panjab and the Ganga-Yamuna Doab was sheltered with vast forest at the time of Alexander's campaign. A notable feature of Indian forest, just as to spate and Lear month, is that "the floral landscape is rarely marked through an absolute preponderance of one species or even an assemblage of species". Further "(the) adjacent approaches to this condition are the Himalayan rhododendron belts (a tree having flowers of blood-red color), the semi-desert vegetation of the northwest, and bamboos in the vicinity in the south and the northwest, usually on old clearing".

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

- Moist Tropical Kinds
- Arid Tropical Kinds
- Montane Subtropical Kinds
- Montane Temperate Kinds
- Alpine Kinds.

This classification is based on the study mannered through H.G. Champion in 1936 and slightly customized subsequently.

Moist Tropical Kind

The forest of this kind is basically the rain forest that is wet and evergreen or semi-evergreen. It is establish in the high rainfall regions where the arid season is short. In spaces where the arid season is either intermittent or more prolonged the forest becomes semi-evergreen. The tree cover in the forest of this kind is extremely thick and extremely high. It is establish beside the Western Ghats to the south of Mumbai and in Assam. Perhaps, in the past, the coastal regions in Orissa and Bengal were also sheltered with this type of forest, but have been denuded now.

Arid Tropical Kinds

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

Montane Subtropical Kind

The subtropical kinds are rain forests having a stunted growth. The two main regions where they are established are the Nilgiris and Anaimalai-Palani Hills in the south. It may have sheltered the Satpura and Maikal Hills and Mount Abu in the past, though mainly of it has now vanished.

Montane Temperate Kind

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

Alpine Kind

This kind grows in the middle stages of Himalaya. The main kinds of trees and vegetation are silver firs, juniper, pines, rhododendrons, and birches.

Soils

Soils support vegetation as also agriculture and have so been of vital importance in giving Indian landscape a definite view. The traditional classification of the soils in India, as noted through 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 effort to classify soil kinds was made through the Russian scientist Z. J. Schokalskay in 1932. This was essentially an effort at synthesising the existing knowledge and its value lay in the information 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 sharing pattern in India. We have given here a map on the pattern of soil sharing in India but it is based on Schokalskay's study as the Soil Survey of India job has not been completed.

Soil conservation has been a significant environmental concern as it sustains vegetation and agriculture both. Several human behaviors have directly and indirectly resulted in soil erosion in a major method causing in some cases an irreparable loss of the soil for posterity. Since consolidation has

to precede conservation, the task becomes harder as persuasive events requiring cooperation on superior level require to be adopted. Soil fertility and soil productivity are other related issues but they require to be addressed through scientists primarily.

Perceptions of Landscape

The account of the physical features of India gives the ideal background to look at the social perception of landscape as it evolved since ancient times. The beginning of civilization in India is traced to the semi-arid region of Sind. The river valleys of the arid region provided appropriate circumstances for the emergence and growth of a civilization based on agriculture. At that time the 'technological constraints' forced humans to not venture to the densely forested regions 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 resolution 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 dissimilar requires of the settlers.

The itinerant character of the new settler necessitated movement towards a greener region and with the 'advent of iron' resolution in the densely forested region became a reality. This was also the beginning of an assault on the forest frontiers. Slowly the agriculture spread, forests shrank, and empires began to take form. The era also witnessed the establishment of republics beside with monarchical kingdoms. It is motivating to note that whereas the monarchies were concentrated in the Ganga plain, the republics, mainly of which pre-dated the monarchies, were ranged round the northern margin of these kingdoms in the foothills of the Himalayas, perhaps due to the information, 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 flanked by the settled agriculture and the adjoining forest regions, information substantiated through Kautilya. He visualized forests and mountains as providing effective barrier against the enemies. He also

supported management of forests to generate revenue as well. Therefore we can suggest that forests and mountains were perceived in conditions of their economic and strategic significance.

It should be noted that the landscape was visualized not only in conditions of the economic and strategic significance but also its aesthetic value that was appreciated. Ancient literature is full of references where landscape has been eulogized in conditions 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 through borrowing sure attributes from the wider natural world and placed within the rituals of the poetry. There are four types of "lay"; each is presided in excess of through a deity and named for a flower or tree feature of the region:

- *Mullai,* a diversity of jasmine, stands for the forests overseen through *Mayon*, the dark-bodied god of herdsmen;
- *Kurinci* (pronounced *Kurinji*), a mountain flower, for the mountains overseen through *Murukan,* the red-speared god of war, youth and beauty;
- *Marutam*, (pronounced *Marudam*), a tree with red flowers rising close to the water, for the rustic region, overseen through *Ventan*, the raingod; and
- *Neytal (*pronounced *Neydal*), a water flower for the sandy sea shore overseen through the Wind God.

Palai is given no specific site, 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 through drought.

Information in relation to the landscape is also available for the medieval era. A secure examination of the Persian sources of the medieval era reveals that the region of Ganga-Yamuna Doab then had a dissimilar landscape. Throughout Alauddin's reign, the region flanked by Delhi and Badaun was densely forested unlike the vast expanse of agriculture spanning the region today with only sparsely wooded regions in flanked by Alauddin

had given orders for clearing the forest to make the passage safe for the merchants in scrupulous and travelers in common. Though, it appears the vanishing act suffered through 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. Likewise, we have information on the political boundary of states defined beside the courses of rivers. In the medieval era the territory flanked by the two warring states of Mewar and Marwar were defined just as to the farming of specific trees. The *anwla* plantation was seen as demarcating the Mewar region whereas Marwar was recognized with the *babool* tree, suggesting a broad division of the territory in conditions of the semi-arid and wet regions.

Landscape was visualized not only in conditions of the type of agriculture it could sustain, but also in conditions of the animal the region could harbor. Historical works of ancient, medieval, and even British era carry enough references to suggest that sure landscapes were defined in conditions of the wild animals establish there. Books like *Man-eaters of Kumaon,* tend to project a scrupulous image of the region based on the availability of sure species of animals in the region.

The landscape experienced a dissimilar type of change with the beginning of the colonial era. India's biological diversity was scientifically documented through 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 creation 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 through the farming of monoculture of commercially viable species. This penetration and promotion of commercial diversities changed the whole landscape of the region. Likewise, propagation of plantation economy in the southern and north-eastern part of the country led to extinction of

natural forest cover replaced again through the monoculture of the commercial plants.

It is not only the forest cover, which gives 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 stage and later on railways to protect the imperial interests.

SOURCES OF STUDY

Survey of Literature

"The languages 'environment' and 'ecology' have been subjected to extensive efforts at definition throughout the past twenty years or so. Already it has been establish necessary to allow them legroom to breathe. So it is also with 'environmental history' or even 'Environment and History'. As with mainly 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 form 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-level where change is less important. Relevant sections of legislation are all part of environmental history."

The effort to describe environmental history through the editor of the *Environment and History* 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 through the introduction of colonialism have dominated the discourse though there are a few significant aberrations too. In the case of India these disruptions were caused through colonialism and some have sustained even after independence. In common historians working on contemporary period have, beside with

economic use, explored the use of natural possessions through 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 contemporary India. Further concerns of historians can be situated in the debate initiated through the revisionist school of history writing and subaltern's effort to explore the role of and impact on the marginal groups of civilization, mainly ignored in the conventional history writing.

Methodologies

The principles and concerns have been the defining features of the environmental history and these have been mainly vigorously put into practice in the case of forestry. Deforestation and associated climatic change has proved to be a vibrant zone. The disagreement in excess of classification of traditional rights and claims of tribal's and their connection with the state polity, initially with pre-colonial state and later on with colonial state have been useful add-ons. The power of these issues in the environmental history can be gauged through the following acceptance through the editors of *Nature and the Orient*: "We make no apology for devoting so much of the book to the history of the connection flanked by 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 instance, directly controlled in excess of one fifth of the land region of South Asia. Moreover, the forest history of the subcontinent and South Asia varies enormously from region to region, 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".

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 utilization was in harmony with nature and resource sharing in the middle of several strata of the civilization was extremely cordial. The caste

civilization with dissimilar claims on dissimilar possessions 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 through a scrupulous economic action and a scrupulous ecological niche. Though, perhaps unintentionally, the notion of self-enough villages was also justified through such arguments. The analysis of the several environmental movements were explained in conditions of disruptions caused through 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'. A romanticized image of the human-environment interaction in the Indian context was therefore portrayed through Guha & Gadgil.

The transition from the study of events and watershed occurrences to the study of procedures and explorations of deeper continuities from an ecological point of view was a gradual procedure. In this the concern shifted to asking how and why sure types of livelihood patterns or manufacture methods survived and how others were transformed. Through replacing the study of events therefore the procedures had begun to inhabit the center-stage.

The relative neglect of the colonial impact on the land through 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. Therefore they looked for evidences of popular protests against the use and often neglected the contrary proof. South Asian works have often focused on sure 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 disagreement in excess of water-rights, etc. There have been a few exceptions though to this common trend. Sumit Guha has tried to bridge the gap flanked by pre-British and British era. His region of study has been the region dominated through Marathas where rich repositories of Maratha documents have been put to excellent use. At the similar time he has also avoided the illusionary divide flanked by forest and agriculture and notions of ethnicity in the wider context

of environment. He has demonstrated with fresh proof that tribal polities did not evolve in separation

Further, Sumit Guha has pointed out that the big regions of Western plateau (Maharashtra) outside the rain drenched Konkan coast were rendered treeless even throughout the heydays of Marathas. The pattern of livelihood has customized 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 procedure 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 conditions. Arid spells could lead to a resurgence of herding. In the effort to examine the deeper stability Sumit Guha has relied upon archaeological as well as anthropological evidences to substantiate historical proof thereby stressing the significance of procedures rather than watersheds or events.

He has argued that it is significant to stay in mind that in South Asian past relatively little region was under permanent tillage and the much superior percentage of land was often in the state of transition at least in the pre-contemporary era. In the analysis of state's perspective of land it has been pointed out that even in pre-British era '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 conditions of fresh revenue possibilities though it had been an arduous and hard task.

In another job, through Nandini Sinha for the region of Mewar alike 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 behaviors in any sub-region was distant more diverse than is often realized. There were no clear-cut stages or phases like hunter-gatherer, herder, settled cultivators, and artisan and municipality dweller.

Colonial Era

It is significant to note that the whole discourse of colonial historiography has been and its later proponents have tried to examine history in conditions of 'evolutionary' time level where succession from primitive to

tribal to chieftaincy to state has been a unidirectional and mutually contradictory procedure. In this context Ajay Skaria's writings deserve serious consideration as there the notion of wild has been seen in conditions of opposition to civilized. The connection flanked by tribal people and state has also been situated in conditions of interaction flanked by civilized and primitive.

Ajai Skaria highlights the common negligence of marginal regions and laments the lack of importance given to traditional issues. He tries to locate the troubles of marginal issues in the context of politics of growth and discovers that the similar is significant for the construction of thoughts such as jangali/tribal/primitive. He questions the notion whereby tribals were equated with 'wild' and 'primitive' and settled agriculture with civilization. He also explores the interdependence flanked by state and tribal polities where revenue rights and power were shared in an intricate web of connection. There has now been an effort to question the notion of a uniform British policy all crossways India and recent researches have pointed out that there was a serious divergence of views on policies related with the forest/land/ agriculture.

Sivaramakrishnan's job 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 effort to formulate Private Forest Bill flanked by 1865 and 1878. Underplay of several social, economic, and environmental concerns made the whole debate so intricate that ultimately the bill could not be formatted. The major issues involved in this debate were property rights sanctioned through permanent resolution and that now any effort to withdraw or curtail the similar would lead to greater resentment. These forests were often termed as Jungle Mahal, hence accepted as private property. This was the era when forests were sought after due to wood, which was in great demand because of railways. Initially with the formation of permanent resolution 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 effort was made through permanent resolution to maximize land revenue but soil conservation and forest produce were also significant.

The other disagreement visible was the claims of the raiyat in excess of the forest produce, which were recognized through custom. 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 through expanding railways further complicating the issue of traditional claims *versus* commercial use. The importance of his approach lies in a thorough exploration of conflicting interest's vis-à-vis natural possessions. There were many claimants and the state had to consider many probabilities before arriving at any formal policy. He also examines the debate in excess of environmental thoughts. It was not only scientific knowledge (in relation to the forests) which participated in the debate but several self interests also tried to appropriate the issue and mend the policy in their favor.

Likewise, Ravi Rajan points out the internal divisions in the colonial perspective. The so-described colonial policy has not been a monolithic structure and there were quite apparent heterogeneous views. The author has extremely clearly pointed out internal divisions in colonial policy through examining the deliberations at the Empire Forestry Conference on two crucial colonial agro-ecological policy concerns, shifting farming, and soil erosion, throughout 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 farming but it was put aside through citing the nature of forests in India. 'The political damage caused through shifting farming was its inducing itinerant habits on parts of the local population, discouraging agricultural progress and facilitating the evasion of taxes'. The troubles caused through shifting farming were not only of tax evasion but the superior issue of timber deal/supply to cater to requires of British was also at the centre-stage. The problem of soil erosion was caused through the cutting of forests for commercial use and the clearing of land for agricultural purposes. It was further fuelled through the ever-rising 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 technological intervention was through no means value neutral'.

The reconstructions of forest histories also require paying secure attention to local and local peculiarities. Ajit Menon has pointed out that 'the forest-dependent societies view land in conditions not so much of ownership but of use.' He suggests that the procedure of colonization depends both on the state's skill to take in excess of big regions of land and the skill of local societies to form the state's initiatives to at least some extent. It is important that the manner in which state policies reach local societies in the Kolli hills continues to be determined through the latter's reception and response.

The attempts to challenge the portrayal of adverse role played through British through arguing that it was the British who initiated systematic forest conservation policy in India is another important region of Indian environmental history. It has been argued that, "the original 'greens' in India were in information colonial officials. Colonial forest policy … was rooted in an enlightened understanding of environmental issues urbanized in scrupulous through a group of extra ordinary Scottish medicos serving in the colonies, which sought initially to understand the connection flanked by climate and health, but extremely quickly became experts in botany and ecology. They argued that there was a secure connection flanked by 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 through active management and manages".

The state-led conservation of forests was legitimized under the guise of imparting contemporary knowledge or banishing the forest-dwellers from their habitat for harming the forests. A balance flanked by agriculture and forests could be achieved through identifying lands suited to the agriculture and marginal land could be urbanized as forests. The primacy of agriculture was therefore quite apparent. The availability of ground water was also a related issue often combined with the soil erosion. At times forest growth was measured harmful for ground-water as it sustained itself on the ground water only.

It clearly brings out the information that colonial concerns with respect to forests were principally guided through covert economic thoughts though overtly predominated through the objective of conservation. The debate in excess of 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 circumstances. Likewise, the aboriginals of the forests were to be protected so as to conserve the primitive form of environment.

Another region of exploration has been the analysis of the several policies having a bearing on the environmental issues. Vasant Saberwal has made a major contribution in this field. He argues that 'there is rising recognition within the academic ecological society of the complexities of ecosystem functioning and the limits to our predictive and explanatory capabilities with regard to big-level ecological phenomenon'. His explanation brings it out that the concerns for conservation evolved in excess of a extensive era of time beside with the growth in the scientific knowledge in relation to the environment. The role of the state in the appropriation of scientific knowledge in support of its claims through the state has also been pointed out through him. He writes:

- "This essay examines the chronological progression of the desiccation debate, and I have situated my analysis in the broader scientific context within which these thoughts were articulated throughout the late 19th and early 20th century. I explore the connection flanked by a scientific paradigm of a given period, and bureaucratic use of this discourse on Himalayan degradation, the institutional context within which the discourse has taken lay, has in a sense, shaped, or directed the discourse. In excess of-time, one observes a two-method procedure whereby bureaucracies may use science to inform a scrupulous rhetoric; at the similar time bureaucratic rhetoric comes to power the scientific discourse itself, and thereby the extremely nature of science".

The changing history of the encounters of humans and animals has become another field of rising interest, both in conditions of changing elite

taste and of ground stage conflicts and co-subsistence. In this context, *The End of Trail: The Cheetah in India* stands out. The author has attempted to trace the history of Cheetah in India, its origin, spatial sharing, attitude towards the animal, gradual erosion of legroom for the big animal and finally the extinction of the specie. It is an significant contribution that helps in a comprehension of intricate relationships flanked by fauna and the civilization, especially the explanation that the extinction of the animal was caused through the side effect of the superior historical procedure and not as a direct procedure of elimination of the species as it was for other 'big games'.

Apparently, the extremely easy procedure of agricultural expansion has resulted in the gradual erosion of legroom for big animals. The shrinkage of the hunting region forced the animals to move in the closer proximity of the humans resulting in violent encounters. The availability of technology placed civilization of the early colonial era in a better location 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 modern civilization. At another stage 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 through the civil power.

Understanding of environmental issues through in depth local histories has become the other region of exploration. The interplay of local identity and ecological niche has approach into sharper focus than in the past. It is motivating that there have been a few detailed micro-histories of a scrupulous range of hills, a watershed, or a valley organization, a reserved forest or a princely reserve.

There have been many useful works on pastures, meadows, and forests of colonial and modern Rajasthan. But except for passing references in studies of agrarian manufacture few have examined the dynamics of water management in Rajasthan prior to 1800. Primary concern of Jodha has been to look at 'the changing status and usage pattern of natural possessions… and the possibilities of arresting their negative trends characterizing these changes'. P.S. Kavoori, has explored the issue of 'general property possessions' through examining the circumstances of the pastoralists in the modern Era. Likewise,

R. Thomas Rosin has established a relative shortage of the 'general grazing land' and the stress in excess of the sedentary lifestyle has reduced the opportunities for the pastoralists. Through the similar token, it also reduces the opportunities available with the peasantry in times of drought and famine. Likewise, for the later era, conflicts in excess of natural resource use have been extensively investigated, i.e., forest protection and conservation *versus* extension of settled farming.

There are many studies highlighting the troubles with the British policies with regard to the forest management where monoculture has been a major issue and the use of natural possessions for 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 tribe's livelihood on the margin of the settled agriculture. It is important 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. The resistance offered through these tribes to the British policies has been extensively examined and it has been argued that British were unable to comprehend the intricate functioning of their social relationships. In mainly of the cases, the problem can be situated in a variation of vision of landscape shared through the British and the reality of Indian landscape. In other languages, the nature of political intervention powers the nature of colonial discourse on ethnicity, environment, and resource use.

Pre-Colonial Era

The broad survey of the writings on the environmental concerns in India cannot ignore the contributions made through historians working on pre-colonial era. The issue of marginal has been addressed with special reference to rustic, tribal, hunter, etc. Francis Zimmermann has examined ancient texts to construct the ecology of the era. 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 arid lands," and *anupa*, "those of the marshy

lands" and pointed out that through closely examining such texts we can infer a great deal in relation to the ancient ecology.

Following more conventional path, Aloka Parasher-Sen has tried for the Mauryan era to 'understand how the state perceived the forest dwellers and sought to subordinate and assimilate them. Geography and the perceived subsistence of the hostile tribes defined the frontiers of the empire and both had to be mastered for the expansion and integration of the state'. The other major concern has been the study of social formations and it has been influenced through the methodologies and apparatus deployed through anthropology and archaeology. Ranabir Chakravarti has highlighted the role of hydraulic management in the procedure of resolution in ancient era.

Few writers have probed the significance of pre-colonial water systems; this is especially true of north and northwest India. In mainly of these studies scholars have stressed the role of traditional village society in construction and maintenance of irrigation mechanisms. David Hardiman suggests, that 'little-dam systems of irrigation lived in the past which were sustained in excess of extensive eras of time… through society based manage.' In the similar vein Elizabeth Whitecombe has argued that irrigation ''works were financed through loan capital. Hence, in the sanctioning of constructions the emphasis was necessarily placed on the prospect of their remunerativeness."

. David Mosse has examined the interplay of 'developmental politics' to explain the stage and procedure of state intervention. The role of society based programmes to tackle contentious issues like management and allocation of 'general property possessions' like water bodies, etc. have also been examined. Water systems have been examined through R.J. Fisher, and Tripta Wahi.

As we move further back in medieval India we discover a common dearth of scholars focusing on environment and on man-environment interaction.

A serious power on the man-environment studies in medieval India has been that of the *Annales*. Powers of environment on the social formations have been a major region of exploration for the *Annales*. Since the extremely

beginning of the movement, we can trace the attempts made through contributors to explore the newer types of sources to examine the role played through environment in historical growths. They have tried to lay the role of environment in the wider settings of social formations and have not remained confined to the colonial impact only. They also effort to transcend the barrier of medieval and contemporary history and have been more comfortable with the whole range of human behaviors in lay of mainly the political history.

Harbans Mukhia is credited with creation *Annales* popular in India through translating the writings of French historians beside with Maurice Aymard. The power of the *Annales* custom is visible in a significant contribution made through Chetan Singh. He has explored the connection flanked by environment and civilization in Western Himalaya: "…But my project rested on the belief that there were some extensive recognized and well understood relationships flanked by civilization and its physical surroundings. … Such fundamental relationships did, indeed exist: a civilization could hardly have survived for any length of time without them. It was, though the clear-cut enunciation of these relationships that was missing. This required the deliberate elaboration both of socio-economic procedures and specific ecological environment within which they operated".

Likewise, Mayank Kumar has also attempted to look at the interaction flanked by environment and civilization in medieval Rajasthan. He has questioned the notion that the traditional civilizations always practiced the methods aimed at a prudent use of natural possessions and has cited many cases of use of nature through traditional civilizations in Rajasthan. He also cautions that the magnitude of use of natural possessions did multiply manifold under the impact of Industrial Revolution.

In any effort to track the interaction flanked by 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 through one civilization as a barrier, yet as a route through another.' Likewise, one should not in excess of 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 in excess of time with the physical environment, of the environment as context, agent, and power in human history. Here, nature figures unabashedly as human habitat, but in a dual capability. On the one hand are ranged those elements of nature-climate, topography, animal and insect life, vegetation and soils-which directly or indirectly form human action and productivity. In affecting land-use and survival, they help to promote or prohibit specific shapes of social structure, economic organisation, and belief systems. They also extend the margins of historical analysis and bring centre-stage a 'cast of nonhuman characters' normally ignored, at least until recently. …But the connection is a reciprocal one, for man more than any other any other livelihood organism also alters the landscape, fells tree, erodes soils, dams streams, kills off unwelcome plants and predatory animals, installing favored species in their stead". Such works would have to delve into a wider set of sources: folksongs and legends, music and lore, locating these against the changing background of human-nature encounters. This would mean looking at both civilization and nature, howsoever defined, in new ways.

REVIEW QUESTIONS

- Describe the features of nature-human interface during Paleolithic and Mesolithic Cultures.
- Why is the beginning of the industrial age considered as marking a major shift in nature-human interface? Elaborate.
- Describe the vegetation of India with special reference to the forest.
- Examine the characteristic features of the literature on environment focusing on the pre-colonial period.

CHAPTER 2

Environment and Early Societies

STRUCTURE

- Learning objectives
- Resource use and human societies
- Hunting-gathering
- Nomadic pastoralism
- Review questions

LEARNING OBJECTIVES

After reading this chapter, you should be able to:

- 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.
- Explain the nature of evidence.
- Describe the geographical spread
- Understand the emergence of pastoralism
- Describe the nomadic communities

RESOURCE USE AND HUMAN SOCIETIES

Nature of Possessions and Social Use

Earth is a unique planet as it contains natural possessions that have given rise to numerous life shapes and have created an environmental organization that has sustained and is compatible with this diversity of life shapes. The reserves of these natural possessions on the earth are enormous

and beside the route of the progress of human societies dissimilar types of possessions have been harnessed through the man. There has, in information, been an intricate interactive connection flanked by human necessities in accordance with specific stages of civilization and the development and use of natural possessions. Throughout the course of this interaction the ambit of 'natural possessions' has been constantly changing and with that the connection flanked by man and his environment has also been changing. The common understanding of the term 'natural possessions' until secure to the beginning of the contemporary age was that they consisted of useful, and so valuable, commodities. Practically they comprised the raw materials which could be purposefully used through human societies. This meant, essentially, that things like water, air and the light and heat emitted through the sun, and forests, land, wild life, fishes, and minerals were natural possessions commonly brought in use through the humans. The contemporary age broadened this concept to contain, as natural possessions, the whole natural environment including all livelihood and non-livelihood things. For our purpose, though, an easy classification of natural possessions has been adopted that divides them into the categories of renewable and non-renewable possessions. In this division the possessions which regularly multiply or get renovated are measured as renewable; the possessions which are available in a fixed quantity, howsoever big, are measured as non-renewable. Non-renewable possessions do not possess the inherent property of multiplication or periodic renovation.

Renewable Possessions

The natural possessions which have the skill to regenerate are usually measured as renewable possessions. An outcome of this skill is that the use or consumption of such possessions is replenished and after a sure time the reserve is again available for use. The renewable possessions are mostly the livelihood possessions such as plants, forests, wildlife etc. They

also contain such natural possessions as the solar energy, air, and water because of their approximately inexhaustible supply. In addition to the above there are also natural possessions that are bestowed with the property of renewal but with a relatively extensive time taken for accomplishing replenishment. In the context of social use of natural possessions they are measured as least renewable possessions or may even be measured as non-renewable. The length of time needed for replenishment is recognized as the cycling time. The possessions having a short cycling time are renewable and those possessions that have extremely extensive cycling time are non-renewable.

The sustenance of human life and its further growth has been mainly dependent on renewable natural possessions. The mainly clearly identifiable natural possessions that have enormous regenerative capability are solar energy, water, and air. Life has been dependent on them so much that we usually do not count them in the category of renewable possessions. In addition, we have two more renewable possessions that have played a very important role in the development of human societies – the plants and animals, and the landscape. We shall talk about them in the context of their use through human societies and shall also look at the resultant interrelationship.

Solar energy, water, and air form a triumvirate that has helped the germination of human life as also all other life shapes and has been responsible for its further progress in an immeasurable manner. If we take human time levels as our point of reference, we discover that solar energy has remained an inexhaustible resource as it has met all human requires since the development 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 establish vital for life. Solar energy is capable of being captured directly or through conversion in other shapes. It was only after the beginning of science in organized manner that conversion of solar energy in other shapes 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 approximately totally absent. We can only assume that the light and heat emitted through sun have been in perennial use through human societies for daily chores, for drying the ripened crops and for regulating their routine works. In information human societies have, from immemorial times, recognized sun as the single mainly significant resource for light and for heat. A diversification of the use of this resource, though, could only be made viable in the contemporary age.

Water is usually measured a perennial natural resource as it meets some of the vital necessities of life on earth. The humans are no exceptions in the matter and use water for sustaining life as also for a diversity of other purposes. Considering the critical importance of this resource the nature has been extremely generous in providing water in ample shapes and ways. The growth of human societies had been, for an extremely extensive time, contingent upon the natural availability of water. In information water has been one of those key possessions that have been supervised through human societies from an extremely early time in its history. Drinking water and irrigation necessities have more often than not determined the contours and pace of development. In this procedure 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 information the availability of water has been in such abundance in nature that a type of recklessness in its use crept in human habits. In excess of many millennia of the abuse of water possessions a situation of supply-crunch has appeared now. Many regions of the world as also of India have been suffering from severe shortages of water.

One of the mainly significant renewable possessions has been the plants and the animals. Right from the beginning man has existed on a food consisting of animal meat and the plant fruits. The availability of food in dissimilar events in dissimilar regions of the country has determined the pattern of resolution and growth of human societies in those regions. Later,

in this procedure, human societies learnt and urbanized the art of agriculture and adopted semi-permanent and permanent settlements as habitats. The environmental circumstances favoring agriculture determined the emergence of society settlements. These settlements were organized in accordance with specific agricultural circumstances. The human endeavour was to grow crops to uphold 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 vital form of human action and the land for agriculture became one of the vital possessions. It provided food to man and fodder to animals; it provided raw materials for ancillary behaviors such as clothing and shelter and other agro-behaviors. The agricultural possessions were dependent on environmental circumstances such as topography, soils, and water-supply and were regularly replenished through cropping action. In this procedure sometimes the environment was allowed to deteriorate and the possessions to diminish. This obviously had a major impact on modern societies as some even became extinct unable to cope with the changes.

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

Non-renewable Possessions

There are some possessions that are replenished through very slow natural cycles (many thousands of years). Such possessions can so be measured as non-renewable for all practical purposes. Since the rate of formation of these possessions is extremely slow, each time they are used

some depletion in their reserve does happen. The rate at which they are used, so, determines whether they are likely to last extensive or diminish sooner. The main non-renewable possessions which human societies have been by since the mainly remote past are metals and mineral possessions and soil. The metals and minerals are sometimes available on or close to the surface or otherwise have to be mined. The soil is shaped in excess of hundreds of years as a result of an intricate inter-action flanked by organisms and the physical surface of the earth. Climate also plays an important role in soil formation.

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 sure stage of the development of technology of extraction.

Here we would like to note that rock was perhaps the earliest material harnessed through man for use in daily chores. This era was the longest in the development of human societies and is described as Palaeolithic era. Mainly of the minerals recognized to us today have been exposed extremely recently in comparison to the time era occupied through the stone by human societies. The metals as a resource first became recognized to man in the era often characterized as the Chalcolithic era. The earliest evidence of the use of a metal through human societies relates to copper and bronze. The use of iron as a resource followed the copper-bronze era. The use of metals was an important stage in the development of human societies as it became the harbinger to a host of critical growths in the subsequent eras that altered the connection flanked by man and environment. A significant property of the metals is that the use of mainly of them does not result in any considerable destruction of their possessions. The metals constantly change form and their malleability allows their use in a diversity of applications.

Soils give a vital support too mainly of the terrestrial life shapes. They are also a significant source of nutrients for aquatic life. The procedure of soil formation involves the breaking of rocks through 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 dissimilar spaces are dissimilar and they also have varying properties. This difference shows its impact on the fertile properties of soils. The vegetation supported through soils accordingly illustrates a great diversity. The growth of human societies has therefore been connected with the nature of soils; in some spaces the soils have supported crops and have helped the transformation of wandering human groups into settled societies, and at other spaces the less responsive nature of soils for vegetational and crop support has given rise to nomadic and non-sedentary societies.

Soils have the tendency to suffer from the acts of erosion through wind action or through the rains. Whereas agriculture has been seen as the outcome of a major use of soil resource through 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 circumstances spread and agricultural region begins to dwindle at varying pace. Soils have also been degenerated from incessant human behaviors without any consideration for permitting regenerative lean eras so vital for recuperating the fertile properties. The grimness of the situation resulting from this degeneration can be ganged from the information that human settlements have been forced to abandon the lay and resort to migration. The problem of the loss of soil fertility has been faced through humans from an extremely early time and several solutions have been practiced to combat the situation. As a natural resource, so, soils have been of critical significance to the humans and have been subjected to a widespread and diverse use through human societies from extremely early in human history.

Resource-Use Practices and their Impact

We have seen above how natural possessions are distinguished flanked by renewable and non-renewable categories. We have also noted the information that human subsistence and the growth of human societies has been contingent upon the use of these natural possessions. In excess of an extensive era of time human societies had urbanized dissimilar practices for use of natural possessions. These practices varied from lay to lay and invoked, from extensive experience of resource-use, many sub-procedures that helped human societies in their further development. We talk about these sub processes briefly before taking up a historical sketch of resource-use practices through human societies and their impact.

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

- Adoption of events that enhanced the reclamation of the resource and at the similar time prevented any wastage of the resource taking lay;
- Adoption of techniques that allowed reclamation of a resource that had not been rendered useful until then;
- Organizing systems that ensured the mainly appropriate uses for specific possessions thereby optimizing their utility;
- Discovering more viable replacements/alternatives in lay of unusual and scarce possessions; and
- Inventing methods and techniques that helped the reprocessing and reutilization of through-products or once wasted resource materials. The resource-use practices adopted through human societies were in dissimilar events mediated through these sub-procedures at dissimilar times.

Pre-agricultural

The mainly significant natural resource put to a widespread use through the humans was stone. At an extremely early stage in the development of human societies the use of stone as a material for shaping some of the vital apparatus was exposed. We do not know the precise time when this detection was made. But we now know with some certainty that the early apparatus crafted from the naturally available stone consisted of hand-axe and the cleaver (a tool used for breaking the granules), and several kinds of chopping apparatus. As stated through All chins, "We still have extremely little common cultural information, as apparatus of this era have only rarely been establish in caves in the Indian sub-continent, and approximately never with the type of job deposit which designates regular environment".

The main locations from where discovers of early tool creation stage have approach are at Soan valley in Pakistan, Narmada valley in Central India (Adamgarh, Jabalpur and Maheshwar), Nevasa in Godawari valley in Maharashtra, Gundla-Brahmeshwaram region in Pennar valley in Tamil Nadu, and Attirampakkam and Gudiyam cave close to Chennai in Tamil Nadu. It is apparent that these locations are few and scattered distant flanked by. The main job of early stone tool societies was hunting animals and gathering fruits and seeds for food. The human groups by such apparatus were ably assisted through their implements in their job. The apparatus were of a crude nature but seemed to job well in the given situations. The kinds of stones used in creation these apparatus were mainly sandstones, quartzites, and shales. Local variations are noticeable both in the incidence of dissimilar diversities of stone apparatus and in the kinds of stones used in creation these apparatus. The procedure through which the apparatus were made has been described through Allchins: "In order to make apparatus big flakes or pieces of quartzite had been removed from the parent rock. It was not always clear whether this had been done through striking the rock with another stone – an operation which would require great strength – or through firesetting that is lighting a fire against the rock and so causing big pieces to breakaway from the main body. Perhaps both methods were used.

Some apparatus, usually cleavers, can be seen to have been made from flakes which had been struck off superior blocks of raw material. But in the case of several apparatus 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 procedure of giving the tool its final form". In the early stone tool manufacture the chief resource-used was quartzite. It appears where quartzite was not available in good supply, other diversities of rocks were used. It is also apparent from the procedure described above that reprocessing and reutilization of wasted resource was a general sub-procedure employed in tool creation. The flakes, which were the byproducts of the manufacture of core apparatus, were utilized on a big level. In the subsequent stages of stone tool creation 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 apparatus that were smaller in size and so used mainly rocks described crypto-crystalline silica, commonly described agate and jasper or chalcedony. Stones of this kind provide flakes of smoother surface. One of the main sources of this stone was the river pebbles. We could now relate the locations of stone tool creation settlements as being situated in river valleys. A significant point for our consideration relates to the manufacturing procedure of these apparatus. Just as to one scrupulous view the flakes from pebbles could only be obtained through by a wooden hammer, in which case the resource-use practice appears to undergo a definite shift as it employs a combination of materials.

The flake by stage of stone tool creation was followed through the microlithic custom. Here the apparatus were mainly made of blades of stones. These blades were parallel-sided and were prepared from cores. They were attached to wooden pieces in dissimilar combinations to make a diversity of apparatus. The forms of these blades leave little doubt that they were made through chiseling 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 possessions 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 locations by microlithic devices were no

more confined to a few spaces or regions. A wider dispersal of this custom had taken lay as microliths were also establish from eastern parts and deep south.

Agricultural

The beginning of settled agriculture marks an important stage in resource use practice. There is a clear shift in favor of soil as a natural resource and the use of stone for creation apparatus also undergoes a change with much greater diversity 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 raising the crop on plots of land, agriculture had begun to get localized. Regions where fresh deposits of soil would approach 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 recognized to human societies. This was also the beginning of a revolutionary change in the use of natural possessions through 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 little in size and appear to focus on regions where good cultivable soil was richly available. This soil was periodically replenished through the floods in the two main rivers, Loralai and Zhob and the valleys of these rivers were therefore 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 diversity 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 era of agricultural development. Dog, it may be noted, had already been domesticated. In a subsequent stage we get the additional evidence of the domestication of ass. Clearly plants, grown from seeds periodically on fixed regions and domesticated cattle became the two main natural possessions that were now widely used through 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 apparatus of the earlier era also underwent a change as the new necessities necessitated the development of smaller apparatus that were more versatile in their use. The agricultural locations yield apparatus made of blades of chert, jasper or chalcedony, rubbing or grinding stones, lunates, bone awls (little pointed tool for pricking) spatulas (instrument having broad blades, used for picking up powder etc.) and drops in steatite, lapis-lazuli and frit.

In addition pottery also begins to appear from this era 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 through the man. The realm of resource-use practice got widened and simultaneously, with the growth of a more intricate structure of human societies, greater diversity of natural possessions began to be used through these societies.

The early practice of agriculture opened many new possibilities. Permanent settlements helped develop society life and broadened the regions in which humans could meaningfully engage. In information the change from hunting-gathering behaviors, which had occupied the major portion of time, to settled agriculture was a quantum shift. The close to assured availability of food supplies gave man time to employ in other behaviors. 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 culture.

The necessity to expand the agricultural region beside the alluvial deposits in river valleys opened the flood plains of such big rivers as the Indus and its tributaries for the culture to germinate and flourish. In spaces like Harappa, Mohenjodaro, Dholavira and Lothal big centres of culture urbanized. These centres were all urban in character and approximately solely dependent for their agricultural supply on the seasonal alluvial deposits of the rivers beside which they had grown. They had, though, urbanized many new resource-use practices. Use of bricks in creation homes was an extra ordinary

characteristic. The bricks were of two kinds – burnt and mud-bricks. A whole new diversity of crops were now grown which incorporated wheat and barley, leguminous plants, field peas and dates. Oil seeds had also become recognized 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 extra ordinary change had occurred in the region of tool creation. Early use of metals is mainly clearly apparent. A range of apparatus made of copper and bronze have been establish from the exhumed locations. Beside with the blades of stone the metal apparatus appear to have equipped human groups with much greater competence in reclaiming natural possessions. We also have evidence that subsidiary apparatus had been urbanized such that good skills in craft job could now be achieved. The use of an extremely thin drill to perforate tiny drops, as seen in Lothal, is a good illustration of craft skills. The sticks from the Harappan locations are also of great interest to us. The sticks are available in such plenty that seal-creation appears to have become a significant craft. Just as to Allchins, "The sticks were sawn from blocks of steatite and cut as intaglios, then toasted in a little furnace to harden and glaze the surface. Their importance was doubtless connected in some method with their role in trading behaviors, but for the contemporary observer of even greater interest are the short inscriptions in the strange Harappan writing and the subjects of the intaglio, several on behalf of scenes of a cultural or religious character".

The early, copper and bronze by, culture that had held a sway mainly in excess of the north-western and western region of the Indian subcontinent declined through in relation to the 1500 B.C. No single cause responsible for this decline has been clearly recognized. We though speculate that a combination of factors may have been responsible. In this the cause suggesting a change in the environmental circumstances of the region definitely interests us. Gregory L. Possehl says: "There was an abandonment, or severe depopulation, of a number of significant Indus settlements …. There was also a disruption in Indus economy. The manufacture of a wide range of special materials, … was curtailed …. The art of writing was no longer practiced.

Extensive-aloofness deal was reduced… A steady deterioration in the climate and environment of the region is often cited as one of the significant causes for the above to happen.

Iron Age

The decline of copper-bronze societies and the emergence of iron by human societies should not be necessarily connected sequentially. Important from the point of view of resource-use practice is the information that the knowledge of the use of iron approximately dramatically changed the scenario of the use of natural possessions through human societies. Perhaps the foremost change was effected in agricultural practices. What had, in the earlier era, remained a river-bank bound agriculture was now transformed into open-field based agriculture. We had noted in the preceding part that soil as a resource had been successfully used through 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 in excess of turn crusty upper surface of virgin soil only soft alluvial soil could be used for agriculture. Since regular alluvial deposits were mainly a characteristic of the rivers in semi-arid & north-western and western India, mainly of the agriculture of that era was spread beside river valleys in these regions. The introduction of iron, especially in the plough share, provided man a fresh and new opportunity to job on virgin regions. 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 regions 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 growths.

We have in the form of Vedic literature an extremely rich source providing information on resource-use practices of modern societies. It tells us that the range of crops grown had expanded considerably as it incorporated 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 big level clearance had become possible due to the use of iron. The other metal possessions that had become recognized were tin and lead. Cattle-keeping had been practiced regularly. The pottery was pre-dominantly "wheel-thrown" and an "extra ordinary degree of standardization" was also achieved. The civilization had become fairly intricate and a set of defined code had appeared 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.

HUNTING-GATHERING

Nature of Evidence

The mainly plentiful material remnants linked with hunting-gathering societies are stone apparatus and implements. In information the other material, if any, might have been of perishable kind and so 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 complemented through the pictorial depictions made through hunting-gathering societies of later eras. These have survived on the walls, ceilings etc. of the cave shelters that were seemingly used through these societies. No other records pertaining to them have survived and we have to bank approximately solely on the surviving assemblages of stone implements and apparatus for reconstructing the livelihood patterns of hunting-gathering societies. In this task we are greatly helped through the methods, techniques and reconstructive devices urbanized through the archaeologists and the anthropologists, though this also entails some limiting possibilities.

The bulk of the evidence relates to stone apparatus and implements which were crafted through the modern people for their use. These apparatus 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 apparatus survive at specific sites which conform

to one or more necessities of their manufacture. Besides the availability of appropriate material, the other thoughts 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 apparatus assume a vibrant character. This makes it possible to reconstruct the main contours of modern societies that are the life-styles of the hunting-gathering societies. In the procedure we are further helped through the pictorial depictions made through the hunting-gathering people as they provide us and thought in relation to the economy and civilization of the pre-historic people. Jointly they – the material evidence of stone apparatus and implements and the rock art – help us recreate the ambience of hunting gathering societies in much sharper focus than ever before.

The emergence of the stone age is usually attributed to the Pleistocene era – that began at in relation to the 1.8 million years ago. We would have been lucky to possess material remnants in a state of pristine preservation from such a remote past. But that was not to be. This remoteness has in information been a disadvantage as environmental changes throughout the in flanked by era have disturbed the context of the stone tool assemblages. Our evidence on stone apparatus and implements has so to be weighed cautiously for its value in reconstructing the social life of the modern humans. V.N. Misra suggests: "Because of the length of time involved and the changes in landscape and climate, mainly of the early locations have been either obliterated or disturbed through natural and human agencies. Also, the modern biological material which could tell us in relation to the survival, ecology, technology, structures, etc. has in mainly cases not been preserved. What has survived is a plentitude of stone apparatus, often dislocated from their original context, and buried in secondary deposits. Such archaeological material has extremely limited value for cultural, ecological, and chronological reconstruction, though there are some relatively undisturbed surface locations which could be usefully exploited for palaeoecological reconstruction by the present as a key to the past. From the beginning of the Holocene the preservation of both locations and biological material is better. But, in the final analysis, precise information for cultural and ecological reconstruction can approach only from exhumed

primary archaeological locations. The number of such locations is, though, as yet extremely little. The cultural and ecological reconstruction of early hunter-gatherer societies which follows has so to be seen against the background of these limitations".

The stone tool assemblage pertaining to the hunting-gathering societies have been classified through the archaeologists as belonging to two major stages of development – the Palaeolithic stage and the Mesolithic stage, based on a set of noticeable differences flanked by the two. Since stone apparatus and implements are the principal evidence providing leads into the social structures of hunting-gathering societies, the evolutionary characteristics 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 era of the use of stone apparatus through human groups. Even here the manufacture and use of stone apparatus has not been a static procedure. Important evolutionary changes are quite visible within the stage. As stated through Allchins, "the Palaeolithic industries of the Pleistocene can be divided into three major groups, on the foundation of the form, size, and methods of manufacture of the principal artifact kinds. The Lower Palaeolithic is characterized through hand axes, cleavers, chopping apparatus, and related artifact shapes. Middle Palaeolithic industries are characterized through smaller, lighter apparatus based upon flakes struck from cores, which in some cases are cautiously shaped and prepared in advance, the Upper Palaeolithic through yet lighter relics, and parallel sided blades and burins". It is clear that the sequential order of the three sub-stages designates a continuous procedure of technological development which necessity has adjusted with the modern environmental setting.

The Mesolithic stage appears after the end of the Upper Palaeolithic era. It is usually measured as a middle stage flanked by the Palaeolithic era and the beginning of agriculture throughout the Neolithic era. There was rise in temperature and the climate became warm and arid. The climatic changes affected human life and brought in relation to the changes in fauna and flora. The technology of producing apparatus also underwent change and the stone

apparatus of microlithic diversity were used. “A progressive change and development in the stone industry towards smaller, more delicately made and varied artifact kinds” was distinctly noticeable. Man was still in the hunting-gathering stage but there was a shift in the pattern of hunting from big game to little game hunting and fishing and fowling also began to be practiced. These material and ecological changes are also reflected in rock paintings.

Geographical Spread

At present the common agreement in the middle of 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 apparatus belonging to this stage have been established runs in excess of the whole country except for a few regions. The region of its spread is mainly sheltered through the Siwalik hills in north-west India and Pakistan and up to Chennai in the South. The region from where stone apparatus of the Lower Palaeolithic stage have not been establish mainly consists of Western Ghats and the adjoining coastal region, north-east India, and the plains of the river Ganga.

On the foundation of their typology, the stone apparatus and implements of the Lower Palaeolithic stage have been classified into two technological traditions – the Sohanian and the Acheulian. The Sohanian apparatus mainly consist of choppers, flakes and cores and the Acheulian apparatus mainly consist of cleavers, hand-axes, scrapers, and blades. This variation is notable since it designates a variation in the eco-environmental settings of the two traditions. Likewise the absence of Lower Palaeolithic apparatus from a few regions also suggests a peculiar environmental setting not conducive for the growth of this stage. The Sohanian apparatus were first accounted from the Sohan river which is a tributary of the Indus. “The faunal remnants from this deposit incorporated the horse, buffalo, straight-tusked elephant, and hippopotamus, suggesting an environment characterized through perennial water sources, tree vegetation, and grass steppes”. The Acheulian apparatus have been establish so extensively that it is suggested that the “first

effective colonization of the country was achieved through the makers of the Acheulian civilization." The hunter-gatherer populations practicing this custom were adapted to a wide diversity of ecozones. These zones ranged from semiarid western Rajasthan, Saurashtra and Gujarat alluvial plain to sub-humid arid 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.

There is a particularly thick and rich concentration of the locations of this custom in central India and in the southern part of the Eastern Ghats. The cause for this concentration appears to be a favorable environment – adequate rainfall giving rise to good vegetation cover which in turn sustained a rich diversity of wild animals. This also explains the absence of Acheulian locations 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 thick vegetation that human settlements became hard. The absence from Ganga plains is explained through the paucity of stone as raw material for creation apparatus and implements. The after that major change was the emergence of the Middle Palaeolithic stage. The hunter-gatherers of this stage occupied mainly the similar regions and the similar habitats as occupied through the Achculian custom. The only regions which showed sparse job were western Rajasthan and the Mewar region and Gujarat plain. Mainly of the "Middle Palaeolithic occupations occurred at open-air locations beside perennial as well as seasonal streams, beside hill slopes and on stable dune surface… and in rock shelters as in Central India."

At in relation to the 10,000 years from now the Upper Palaeolithic stage appeared accompanied with arid climate and sparse vegetation and animal life. This restricted the food possessions of hunters-gatherers and with that the population might also have fallen. There is a noticeable sparsity of locations in Rajasthan and Gujarat as also in Central India. Only in the Eastern Ghats do we notice more extensive occupations. Some of the locations in this region are exceptionally big covering almost five acres and yielding an assemblage that runs in thousands. The Mesolithic hunting-gathering societies are usually measured the last of the group, a successor of the Upper

Palaeolithic stage and the predecessor and sometimes a coexisting society with the agriculturists. The Mesolithic locations distant out number all the other locations of the preceding eras. The density of these locations, it may be noted, also increases greatly.

The main regions occupied through Mesolithic people sheltered 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 through Mesolithic people that had remained uninhabited in the previous eras. These incorporated the Ganga valley, Damodar valley, the Kerala coast, and the Southern Tamil Nadu coast. The forest-sheltered alluvial plains of the Ganga valley were effectively colonized through the Mesolithic pioneers. Almost 200 locations of this era have been situated in the south central part of the valley in Allahabad, Pratapgarh, Jaunpur, Mirzapur, and Varanasi districts.

The diversity in job available from this era has been aptly described through V.N. Misra: "Mesolithic societies exploited a greater diversity of habitats than their precursors. 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 sites. The limestone caves in the Kurnool district of Andhra Pradesh were also occupied throughout this era. In the wooded ecosystems of the interior Peninsula there is numerous locations right in the habitat of the shifting cultivators of the present day. Beside the west coast, close to Bombay, the Mesolithic groups settled on the tops of hills and rock outcrops close to the sea coast. Close to 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 use. Likewise, the occupations on the shores of ox-bow lakes in the Ganga valley (e.g. Sarai Nahar Rai, Mahadaha and Damdama), those secure to water falls in the Telangana plateau (e.g. Gauri Gundam and Pochara), approximately Chitrakot Falls in Bastar, and in the riverine niches of

the Eastern Ghats indicate considerable dependence on aquatic food possessions,".

Features

The popular perception that hunting-gathering societies existed a primitive life closer to barbaric behaviour is a distant-fetched imagination. Based on the stone tool assemblages, the locations of their find, and the pictorial depictions available at rock shelters it is possible to deduce significant details. Some of the feature characteristics that emerge from this indicate that hunters-gatherers existed a social life that was composed of family, local groups and wider social ties beyond the immediate family/ local group. The stone apparatus and implements associated with them strongly suggest that the more notable ones came from big factory locations, each of which would have catered to a big region, and as suggested through Allchins, "perhaps also been used through societies of several dissimilar types and sizes." Further, "The means of sharing of this high excellence raw material necessity have been either through several people visiting the location or through that livelihood close to it having an organization of swap with people from other groups. There are examples of deal or swap from several early settlements, which overlap in time with Mesolithic societies".

The information on stone tool assemblages and the pictorial depictions at rock shelters collated jointly present a motivating scenario. Alchins say that "dancing scenes in the caves of Central India depict gatherings which necessity has incorporated quite a number of families or bands. Occasions such as these are recognized to have provided hunter-gatherers in several 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. So it appears highly almost certainly that they did so in the case of the Stone Age inhabitants of several parts of India. Such gatherings would also facilitate the passing on of stone working and other techniques".

Accounting for dissimilar stages of stone tool manufacture we discover that the excellence of stone apparatus and implements evolved with each succeeding stage coming into subsistence and beside with this the interchange flanked by hunting-gathering societies and their environments also got altered. The stone apparatus of the Palaeolithic era were used for dissimilar functions which besides hunting and butchering also incorporated shattering and breaking open bones for taking out the marrow. These apparatus were also used for digging the roots and tubers and in some cases for creation other apparatus. In the succeeding eras the heavy apparatus of the corevariety such as choppers slowly went into oblivion. Their lay was taken through apparatus mainly made of flakes and blades. Many types of scrapers, points, and borers now came into vogue. The locations now preferred spaces which provided quartz and basalt as the vital raw material. Clearly, several of these apparatus were used for creation spears with the help of which the animals could be hunted from aloofness. Pictorial depictions on the rocks clearly provide scenes where animals were killed with the help of many spears thrown through the hunters-gatherers, from aloofness without creation a direct physical get in touch with.

The microlithic stone apparatus suggest a distinctly changed behaviour. The hunting was now undertaken with the help of devices that were the prototypes of traps, snares, nets. It is suggested through V.N. Misra that the hunter gatherers of this era also used the gum of many species of Acacia, lacquer from the nests of tree ants, and a type of milky juice which hardened on exposure to air into a black catechu–like substance for hafting purposes. Likewise, several strands of thin cords were made into a net for fishing.

The features of the Mesolithic hunting-gathering societies are vividly 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 illustrate the hunt of a diversity of game with spears, bows and arrows, all tipped and barbed with microliths, hunters chasing and cornering the game; shooting arrows at the prey; transporting the kill; butchering; fishing through by net traps (26 diversities of fish have been recorded in the rock painting); and trapping of little game, birds, rats and

turtles. Women are shown participating in cornering the game. Other food gathering behaviors shown in the paintings are collection of fruits, women carrying baskets full of fruits; honey collection; and by rubbers and querns. Another important characteristic linked 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.

Local Variations

The discussion necessity have made it clear to you that the hunting-gathering societies existing throughout the Palaeolithic and Mesolithic stages were through no means homogenous societies sharing in general all the features. The surviving evidence, in information, makes a strong case for considerable local variations in the middle of them mediated mainly through the interchange flanked by the hunting-gathering societies and their specific environmental settings. We shall look at this interchange and shall make an effort to delineate the consequent local variations. In the Lower Palaeolithic stage we have already noted the subsistence of two dissimilar strands of hunter-gatherers – the Sohanian and the Acheulian, and their dissimilar environmental setting. While Sohanians remained situated in the valleys of the Himalayan flank, the Acheulians adapted to a wide diversity of ecozones and within these broad zones occupied microhabitats that illustrate quite diversity. The camping locations of Acheulian hunter-gatherers were situated:

- Beside 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, beside perennial as well as seasonal streams; and
- On gravels in peninsular rivers.

Likewise the local variations in Acheulian hunter-gatherers did also approach in relation to the based on the raw material used for tool creation. While quartz and quartzite were the mainly 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 urbanized at a time when glaciations in high northern altitudes was taking lay. This had given rise to circumstances of strong aridity in regions bordering the cold northern altitudes. Rajasthan, Mewar and Gujarat had approach under the spell of aridity and so illustrate sparsely situated locations belonging to the hunter-gatherers. The valleys of central Indian rivers, Chambal, Narmada & Son beside with their tributaries abound with camping locations of hunting-gathering societies.

Some notable changes in tool creation technology also took lay throughout the Middle Palaeolithic stage. The use of bifaces declined and flakes and blades took in excess of. "These were made through the application of retouch, that is, through finely trimming the edges of parent flakes through the removal of tiny thin flakes or chips." The use of quartz and quartzite, and basalt was slowly shifted to contain the use of chert and jasper and fine-grained siliceous rocks. A significant point to keep in mind here is that transport of raw material in excess of extensive distances for tool creation had approach to be practiced even if in rudimentary form. The hunting-gathering societies regularly visited the locations of tool factories from where they composed finished apparatus.

The local difference became more clearly discernible throughout the Upper Palaeolithic stage as they got associated with some important 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 flanked by Jaisalmer and Ramgarh there urbanized sand deposits and sand dunes. Alike aridity engulfed the other northern and north-eastern regions. The green environment now survived in the peninsular India. There was therefore a notable shift in the hunting-gathering societies' camping locations towards south. The main stone apparatus from this stage were scrapers, burins and retouched blade apparatus. From a location in

Kurnool Caves an assemblage of bone apparatus have also been establish. The ecosystems in South were rich in plant foods like fruits, nuts, bamboo shoots and grain and leafy vegetables and mushrooms. Another important characteristic of these locations is that some of them yield evidence on fishing, both riverine and marine and the use of other aquatic foods such as prawns, crabs, tortoises etc.

The sharing of locations belonging to the hunting-gathering societies of this stage has been quite wide and a big number of these locations have also been investigated. The principal local variants approach from the Thar desert – Aravalli Hills region in north-west, and Gujarat – Central India, Ganga plain in Uttar Pradesh, and Karnataka and Tamil Nadu in peninsular India. We shall briefly talk about here the principal locations belonging to these local variants. Budha Pushkar and Bagor are two mainly significant locations from the Rajasthan region. Budha Pushkar is a fresh water lake and has a unique distinction of supporting environment beginning with the harboring of a concentration of microlithic locations to the present day. Analysis of the finds designates that the microlithic locations here were primarily livelihood or camping locations. It also suggests an overlap with the subsequent semi-urban chalcolithic stage. Bagor location is to the east of the Aravalli hills situated on a dune on the bank of a seasonal tributary of Chambal. The key findings from this location are:

- A distinctive mincrolithic factory;
- Human burials of the dead;
- Evidence of huts with paved floors;
- Evidence of domesticated sheep and goat, dissimilar species of deer, wild boar, jackal, rat, monitorizard, river turtle and fish;
- Pottery and three copper arrow heads.

It is also suggested that in excess of an era of time the hunting-gathering societies associated with this location shifted to crop based agriculture as their mode of livelihood. The Gujarat region location is at Langhnaj. It shows a cultural sequence alike to the Bagor location. The Central India locations are situated on little hills and provide evidence on the

creation of apparatus and implements and waste material left after finishing the apparatus. There are many superior locations which fit the size and characteristics of factory locations. Perhaps these superior locations were serving the societies coming there from distant spaces. The situation in the Ganga plain in Uttar Pradesh was dissimilar. A significant location situated at Sarai Nahar Rai appears to have been a location under job through societies that existed their permanently. It is suggested that such societies received their supplies of apparatus and implements from central India locations and had therefore urbanized a pattern of relationships flanked by two geographically dissimilar regions.

The peninsular locations in Raichur and Bellary districts of Karnataka yield motivating evidence. They appear to use raw material predominantly consisting of milky quartz. It is argued through 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 establish. The jaspers and chalcedonies so general in the volcanic rocks farther north are in short supply, but they do happen in spaces and they are present in some river gravels. Both earlier and later peoples undoubtedly establish these sources, but several of the southern microlithic assemblages are approximately a hundred per cent quartz".

NOMADIC PASTORALISM

Emergence of Pastoralism

The early evidence on human groups and their habitats suggests that the animals establish in the vicinity were hunted for food assisted through stone apparatus and implements employed in butchering and skinning besides of - course in hunting. Whenever the animal population in the region depleted, the group was obliged to move to sites which provided enough supply of animals again. The species of animals so hunted for food are not extremely clear. The fossil remnants establish from the Narmada region indicate six diversities viz. *Sus namadicus, Bos namadicus, Elephas hysudricus, Equus namadicus, Hexa-protodon namadicus,* and *Stegodon insignis-ganesa*. All of

these species existed from the Middle Pleistocene age. Likewise fossil discover at Pravara river yields evidence on *Bos namadicus*, *Equus namadicus* and *Elephas namadicus*. These species can be roughly equated with diversities of wild ox, horse and elephant which later became the domesticated species. The hunting human groups often got their animals from the similar herd where the concentrated mostly on superior members of the herd. In this procedure sometimes the young members of the herd were captured alive and kept in cages. This practice seemed to have germinated the thought 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 appears the hunting-gathering societies had begun to focus or some species of big animals for diet fairly early and in this procedure 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 arid up. The chance capture of a few younger animals and the experience gained in taming them suggested a totally new method of leading life - through assured supply of animal food. This would also have given rise to an increased element of dependence – in information mutual dependence flanked by humans and animals. It has been suggested that three main factors in the life approach 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 many environmental factors, therefore rising the possibility of their capture and confinement through human groups;
- Possibilities of breeding the animals under circumstances of captivity, therefore helping human groups uphold some optimum population for use for dietary purposes regularly;
- Manage of the feeding of the animals in captivity to improve their breeding and stock.

The archaeological evidence for early domestication of animals is both unusual and fragmentary. Mostly it is not possible to clearly distinguish

flanked by the bones of wild and domesticated animals. The procedure of domestication was quite prolonged and the earliest evidence on domestication, relates to dog but that surely was not for food. Through common agreement it is now whispered that sheep and goats were the early species that were domesticated for dietary purposes. A significant factor that would have played an important role in domesticating animals was the behaviour of the animals. As suggested through Andrew Smith 'the first domesticated animals came from better-disciplined wild herds in arid environments, where it was easier to manage the movements of animals'. Some animals, because of their behavioral habits, were extremely hard to domesticate. The sheep and goat are comparatively little animals and had good herd habits. It may so have been easy to stay them under captivity, the habits of livelihood in herds helping the captured flocks take to circumstances of captivity. Sustained get in touch with humans who tended them in captivity also resulted, in excess of an era of time, in the growth of a 'symbiotic connection with people' as suggested through Brian M. Fagan. 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 byproducts 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 through W.A. Rodgers illustrate this point clearly: "Several 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 beside with other species. Their typical diurnal and herding habits would have made hunting relatively easy. As mainly of these species prefer open, well-watered country, it is likely that they were a resource significant enough to defend from other groups of people. This would have led to some form of territorial ownership.

Much has been said in relation to the India's lack of grasslands. There are climatic and edaphic grasslands, at extremes of cold and aridity or shallow soil or deep water logging. Basically any habitat which will not support trees or shrubs becomes grassland. These grasslands have supported separate big

grazing herbivore societies, with many endemic species. But these are still a little proportion of India's land surface, mainly of which supports a wooded vegetation, forest woodland, or shrubland. The attendance of a tree layer does not eliminate grasses; there can still be an important grass cover under the trees. Whilst traditionally one associates African pastoralism with grasslands, the Massai of East Africa being a prime instance, not all pastoralist livestock populations browse as do sheep and cattle in Indian circumstances.

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

It is perfectly feasible, so, to imagine pastoralist people in India's forests. We see this today with the Jammu Walla buffalo herders in the once thick Shivalik and Himalaya forests, depending on lopping tree leaf; and in drier Aravalli and Saurashtra hill forests, with separate Gujjar societies lopping trees and shrubs for mixed cattle and buffalo herds." It has been suggested through Brian M. Fagan that the beginning of the practice of domestication had a distant-reaching impact from the eco-environmental perspective. "Domestication implies a genetic selection emphasizing special characteristics 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 manufacture could be achieved through isolating wild populations for selective breeding under human care. Isolating species from a superior gene pool produced domestic sheep with thick, woolly coats and domestic goats providing regular supplies of milk, which shaped a staple in the diet of several human populations".

In India the mainly clear evidence on the domestication of animals comes from the location situated at Adamgarh hill in the Narmada valley. The location is in information a rock shelter that contains stone apparatus and other remnants from the Mesolithic stage. A thick layer of black soil varying in depth from 50 to 150 centimeters contains microlithic apparatus, animal bones and pottery. "The animal bones establish in the excavation contain 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 remnants 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 almost equal proportions, and a few of the bones of cattle, pig and spotted deer are charred".

Extremely motivating 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 recognized as Morhana Pahar group situated secure to Mirzapur in Uttar Pradesh. The drawings on one of the walls illustrate two spoke-wheel chariots. One chariot is shown as drawn through two horses and another through four horses. There is a group of men having bows and arrows and spears and trying to stop the chariots. The location has acquiesced microlithic apparatus.

Pastoralism and Nomadic Societies

We have the genesis of the practice of pastoralism at some length and have seen how animals were tamed and reared through some hunting-gathering societies. We shall now make an effort to understand why sure human groups adopted pastoralism as their lifestyle and became nomads. This question assumes greater significance in view of the information that animal keeping was also an extremely general practice followed through settled agriculturists who had adopted a mode of livelihood in which pastoralism was given an ancillary status.

A convenient starting point for understanding the factors that may have given rise to nomadism in the middle of pastoralists as against a properly settled mode of livelihood in the middle of agriculturists is to draw a comparison flanked by the two manners of sustenance. The pastoralists and the agriculturists depend on land and water possessions 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 through them use the possessions of land as pastures for grazing purposes but pastoralists do not resort to any adopted events for rejuvenating the forage on fixed regions of land. In the like manner the water possessions are directly used without any focused effort to manipulate them. Therefore the sedentism required for manipulating land through the agriculturists is not needed in the case of pastoralists. The constant requirement of additional pasture land for the herds maintained through pastoralists makes it an imperative on them to be always moving, in search of new pasture regions from one lay to another. This provides rise to nomadism and early rustic practices tend to get associated with nomadic societies.

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 rustic economy was more individualistic than agricultural economy. The major society issue in the middle of nomadic pastoralists might have been the management of pastures invoking strict regulations in relation to the use with respect to the periodicity of usage and seasonal rights of usage. The nomadic pastoralists, says Romila Thapar “usually had a fairly conventional organization, with marginal variations. The family shaped the core and patrilineal descent was often traced from a general ancestor”.

Ecological and seasonal factors seemed to have played a central role in the life of nomadic pastoralists of the early era. Unmanageable distances traversed in search of good pasturage and water sources would have had a destabilizing effect on the group. This would have given rise to some type of territoriality, howsoever loosely delineated. Subsequently, interaction flanked

by dissimilar territorial groups may also have been possible as much as a disagreement in excess of territorial jurisdictions. In this context one may speculate on Morhana Pahar rock painting showing the method-laying of two chariots through men equipped with bow and arrow and spears as perhaps indicative of territorial trespass.

Nomadic Pastoralism and Settled Societies

Hunter-gatherers slowly evolving into a rustic civilization and agricultural sedementism have been simultaneous procedures. It is apparent that the nomadic pastoralists did not live in separation of other societies and would have maintained a connection with them. It is suggested through Romila Thapar that some "pastoralists were nomadic…while others were semi-sedentary, occasionally practicing a minimal agriculture as well. Mainly pastoralsits were part of an organization of swap that brought them into get in touch with cultivators and others". The archaeological locations yielding evidence on domesticated animals suggest that the size of the herd maintained through pastoralsits was not unduly big, was within manageable limits and so prone to developing "active symbiotic dealings with neighboring groups producing cereals".

The connection flanked by pastoralists and cultivators was of advantage to both. The cereal necessities of the pastoralists were fulfilled through the farming societies. The additional labour rigorous job of rising food-crops was so conveniently avoided through the pastoralists. They could provide mainly of their time to keeping the animal herds in order. In return the agriculturalists received a regular supply of meat, wool and hide. In excess of an era of time there would take lay a multiplication: in the diversity of animals partially in response to a demand created through the agriculturists. The herd was also encouraged to visit the post-harvest meadows 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 through the cultivating

groups. The agricultural fodder was perhaps a thing of swap for this service in addition to a few other commodities.

It is motivating to note that a dissimilar environmental situation obtaining in peninsular India gave rise to a dissimilar type of development. Though the region is usually rugged the drainage pattern of the main rivers has been such that pasture land in patches but in excellent condition has been available all in excess of. The settlements in this region exhibited a high imperative of maintaining a big population of cattle right from their inception. Livestock maintaining was in information not as much a problem as depending entirely on farming. As suggested through Bhattacharyas "Cattle pen and ash mounds establish in some of these locations can indicate that animals kept were big enough in number to require circular grazing. Such periodic migrations bring the pastorals in get in touch with settlements of higher civilization through which products of craftsmen discover their method in them".

REVIEW QUESTIONS

- What do you understand by the terms 'renewable' and 'non-renewable' resources? Discuss.
- Examine the main resource-use practices during the pre-agricultural period.
- Examine in detail the nature of evidence pertaining to hunting-gathering communities.
- Carefully describe the geographical spread of hunting-gathering communities and the main stages of their expansion.
- Discuss the factors giving rise to pastoralism in early history.
- Examine the nature of relationship between nomadic pastoralists and settled agriculturists in early history

CHAPTER 3

Environment and Agricultural Societies

STRUCTURE

- Learning objectives
- Origins of agriculture
- River valley civilization
- Agricultural diffusion and regional specificities
- Review questions

LEARNING OBJECTIVES

After reading this chapter, you should be able to:

- Discuss the transformation of hunter-gathers societies in societies that began to cultivate cereals and took to other associated developments in agriculture
- Discuss the agriculture pattern of Indus civilization 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.
- Explain the nature of agrarian expansion in the aftermath of Harappan civilization through the pre-colonial period in North India
- Explain the several issues related to expansion of agriculture in various regions of peninsular India from the proto-historic times to the medieval period

ORIGINS OF AGRICULTURE

Neolithic Revolution

The changes introduced in the stone artefacts that made smooth surfaces, and well-rounded and symmetrical forms possible were of such distant-reaching consequences that they were termed as ringing an extra

ordinary shift in the stage of human development. V. Gordon Childe described this stage as 'the Neolithic Revolution' as he noted that the impact of the new stone apparatus and artefacts on human life was of enormous significance. "Childe argued that once Neolithic apparatus began to be made, they would in turn make it easier to cultivate the soil. This would approach in relation to the when humans exposed that they might not confine themselves to collecting wild granules, but augment their food supply through themselves putting seeds in the ground. Ground stone axes would help cut trees to clear the ground much better than the earlier rough apparatus; 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 growths would take lay, not directly attributable to Neolithic technique, but certainly to agriculture. As farming became more widespread, domestication of cattle would be put on a firmer base. 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 societies, inhabiting villages, could now arise. These societies would in time be able to produce a surplus, that is, grow more food than the producers themselves required for their bare survival. Use of clay and mud-brick construction would enable the surplus grain to be stored. Such surplus could then also be appropriated through non-producers, establishing their right through force, the right in time confirmed through cult and custom. Classes, private property and the state now made their appearance, based on such expropriation of the surplus".

There has been some debate on the use of the word "revolution" to denote the onset and continuance of the Neolithic stage of civilization. Since the common time span of this stage is measured 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. Though, as suggested through Irfan Habib, "we require to compare the pace of change achieved throughout the Neolithic Revolution with the pace witnessed

earlier. The previous Mesolithic age, characterized through 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, approximately c.7000 BC. It is this relative shortness of the Neolithic stage, beside with the immense changes it brought in relation to the in man's social life that makes it deserve the term 'revolution'".

The domestication of plants and animals a feature characteristic of the Neolithic stage of civilization set on course a self-enough food producing economy. The inhabitants obtained assured supply of food through farming of cereals and they also began the practice of domesticating animals. An extra ordinary change in their life-approach took lay. Not dependent solely on the environment for food possessions necessitating a periodic shift in their spaces of environment in search of fresh supplies of food, the human groups now began to lead a more settled and sedentary life.

Early Agriculture and Environment

The beginning of agriculture, as we have said earlier, was an event of extremely distant reaching consequences. It was also an event that had demarcated a definite shift in human connection with environment. As a matter of information a marked change had taken lay in the environmental circumstances obtaining in the part of the world with which we are concerned. A perspicuous account given through Bridget and Allchin explains this circumstance. They write: "At the end of the Pleistocene, almost ten thousand years ago, climatic circumstances more or less alike to those of today were recognized in West and South Asia. This provided the setting for man to make a number of significant advances in his manage of the environment, and set in train a series of events which led ultimately to the appearance of the first urban civilizations in both regions, some six thousand years ago. Perhaps the mainly fundamental advances were the domestication of many breeds of animals and plants". Clearly, environmental circumstances 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 in excess of into South Asia. The proof available today suggests that the people of Syria and Palestine were the first to practice agriculture. They were recognized as Natufians "after a camp-location in the Wadi-el-Natuf, in Jordan", and "used sickles of little flint blades set with gum into the grooved shafts of bone. The blades were finely notched and set in a row 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 through pounding the grain into flour, and stone mortars were establish for the similar purpose". 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 apparatus without pottery ('a ceramic' or 'preceramic') obtained from Ghar-i Asp or Aq Kupruk II in northern Afghanistan; more sure appears to be the date of c.7500 BC obtained from the nearby location of Ghar-i Mar or Aq Kupruk I". Surely the agricultural techniques from West Asia had diffused in excess of Afghanistan from where they had to cross in excess of into the Indus organization.

This early agriculture had a profound impact on human-environment interface, as stated earlier. As a result of an intricate interplay of sedimentary civilizations with their environments new social and economic structures appeared. The procedure of their emergence and their features have been described through 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 approximately universal aspect of civilization. It may well be that this interest gave rise to some of the mainly significant 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 establish today, at the folk stage, 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 regional gods and goddesses some of whom remain unassimilated while others have been absorbed at dissimilar stages into the sanskritized hierarchy of gods of the 'great' or classical Indian custom. There can be no doubt that an extremely big part of this contemporary folk religion is very ancient and contains traits which originated throughout the earliest eras of stock raising and agricultural resolution.

"Also associated with permanent resolution were a series of new crafts involving significant technological discoveries. In the middle of these were the manufacture and use of pottery, in time to become ubiquitous as a trace of human job; and the detection of the smelting of copper and its alloys, and their use in the manufacture of apparatus and weapons. The stone industries of the early settlements throughout South Asia illustrate considerable variations from location to location and from one region to another. They also vary from one cultural stage to another at locations with prolonged job such as Amri and particularly Mehrgarh. At the latter there were regional supplies of bitumen which survives in the excavation and, being used in hafting, allows us to see how stone artefacts form component parts of dissimilar apparatus. In all cases the lithic blade industries of the early resolution are closely related to those of the regional Mesolithic locations with which they share sources of stone and vital technology. The local, cultural and chronological variations are in the kinds of artefacts made from blades and flakes, and in their relative proportions. All assemblages at this stage are varied and clearly planned to serve several purposes"

Early Agriculture: Regional Dispersal

The successful use or domestication of many species of wild plants and the consequent rise of sedentary settlements were procedures that showed multiple patterning in excess of such a big geographical region as South Asia. Moreover climatic divergence and same differences in excess of physical environment were supportive factors of such a patterning. Dissimilar plants

and resultant crops establish favor in dissimilar regions. The early agriculture of the region South Asia can be divided into many sub-regions each showing some difference from others.

Baluchistan

Baluchistan shapes the border region with the Indus organization. The spill-in excess of agriculture from West Asia via Afghanistan had taken lay in this region before it reached the Indus organization. The environmental circumstances obtaining in this region are, so, of interest to us as that is likely to explain in the emergence of agriculture there. As stated through Bridget and Allchin, "The climate (in this region) is one of extremes, the summer temperatures being extremely high, and the winters often extremely cold, with snow lying for up to two months in the higher valleys. Given these climatic circumstances, the choice of habitations for societies of the Neolithic era necessity has depended primarily upon their suitability for varying rustic and agricultural necessities. As the rainfall is usually less than 10 inches per annum, mainly falling in the winter months, water for men and animals was obviously a prime necessity in location site. Because of the scarcity of water, settlements were never big, unless they coincided with a good permanent spring or source of water. This scarcity also set strict limits upon the manufacture of crops. Consequently a rustic 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 suitability of this region for the growth of agriculture has also been testified through others. Possehl writes: "A number of scholars have observed that the Afghan- Baluch region is environmentally and ecologically extremely much akin to the whole Iranian Plateau and the uplands of the regions bordering the Mediterranean: It has a steppe-like excellence with pistachio, juniper, and almond tree cover, beside 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 Close to East on

crossways the Iranian Plateau to the Punjab and Western Sindh. What this tells us is that the Afghan-Baluch region is a perfectly reasonable lay for both wild barley (which is documented) and wild wheat to have been establish".

The two major locations of interest to us in this region are Kili Ghul Muhammad and Mundigak. Kili Ghul Muhammad has acquiesced proof relating to the domestication of cattle-sheep, goat and oxen and of mud-brick homes suggesting sedentary method of life. The location appears to have urbanized in many phases and pottery too appears in a later stage supporting settled method of life for its inhabitants. Mundigak, the other location, also gives proof of permanent resolution. Initially the homes were like oblong cells made of pressed earth but subsequently superior homes began to appear. They were made of sun-dehydrated bricks and had more than one enclosed livelihood room. Bridget and Allchin write: "Domestic hearths are establish from the beginning, and ovens, presumably for baking bread, are situated at first outside the homes, and later, perhaps in the court yards".

Indus Organization

As a geo-historical entity Indus valley is quite well recognized. We have described the similar entity with the name Indus organization to make it a little more flexible and provide us the facility of including some of the fringe regions to make our account cogent. The environmental circumstances of the Indus organization have been graphically described through Bridget and Allchin. They write: "The Indus plains offer an extremely dissimilar environment from the upland villages of Baluchistan. Even despite contemporary flood manage events, 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 in excess of big regions of the plain, was almost certainly the similar in several compliments at the time of the earliest settlements on the edge of the plain. The rate of accumulation of silt throughout the era has been such that not only necessity several characteristics of the valley have become submerged, beside with any early locations associated with them, but the plain itself necessity have expanded in region, rising 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 through 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 necessity then, as now, has supported a thick gallery forest. These forests were until recent times rich in game, and necessity have provided attractive hunting grounds. So too necessity 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 realized, and means were exposed of overcoming the troubles of protecting settlements on the flood plain from inundation, an entirely new kind of life became possible. On present showing this development took lay in many stages, reaching its culmination approximately the opening of the third millennium B.C".

It is clear from this account 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 regions for agriculture as a precondition. This region has acquiesced rich proof of early agriculture through a fairly well exhumed location recognized as Mehrgarh. Mehrgarh is locate don the banks of Bolan river at an aloofness of almost 150 kms from the Quetta valley. The exhumed location shows three dissimilar stages of resolution all of which may be termed as Neolithic settlements. From the beginning it the environment comprised of homes made of sun-dehydrated mud-bricks having many smaller rooms and a hearth. "The attendance of agriculture", as stated through Irfan Habib, "is attested through discovers of seeds: the bulk are of naked six row barley; the other sub-species of barley like hulled six-line and two-line, and of wheat like einkorn, emmer and hard are present in little amounts". He suggests "Such cereal farming had almost certainly spread from West Asia. Agriculture appears to have given an impetus to animal domestication. Goats were already domesticated and the humped ox and sheep began to be tamed and bred from captured wild stock". The other

proof pertaining to agriculture and so of significance to us is the appearance of mud-brick structures of rising sizes, as we move from the earlier stage, to a later stage supposedly used as granaries. Moreover another specific discover of great relevance is sickle blades of stone set in bitumen. This is perhaps the earliest indication of the use of apparatus specifically for agricultural purposes. Clearly otherwise arid zone harbored agriculture due to environmental circumstances made available through alluvial carrying rivers.

Northern Valleys

Proof of early agriculture in this region is best accounted from the Kashmir region. There are two principal locations in Kashmir that provide us useful material proof on early agriculture. From Burzahom, secure to Srinagar, we get information in relation to the 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 almost certainly reached through steps. It is, though, important that direct proof for agriculture in Burzahom has not been available. The other location, from where such proof has been unearthed, is at Gufkral. From the early stages we discover proof that suggests that wheat, barley and lentils were grown through them. Domestication of sheep and goats is also accounted. As suggested through Bridget and Allchin, the Kashmir valley civilization "appears as a regional version to the special environment of the mountains, its people having rich sources of food from hunting and from agriculture".

East

The region East of the Indus region is dissimilar from the Indus region environmentally as it has been a region of high monsoon rainfall. The Mesolithic settlements have been present in this region from an extremely early time and the beginning of agriculture has in several cases been in continuation of this civilization. There are two main locations, at Koldihwa and Mahagara, which yield motivating proof on early agriculture. The environment at these locations was in circular huts which were raised on

wooden posts. The marks of holes left behind through these posts provide us a fair thought of the form and size of the huts which were usually circular in disposition. The mainly important discover are husks of rice indicating that this almost certainly was the earliest rice rising civilization. The wet environmental circumstances resulting from monsoon were almost certainly a prime cause for rice farming. The view that Koldihwa and Mahagara were the earliest rice rising spaces has been contested through Irfan Habib. He is of the opinion that the dates of Koldihwa-Mahagara locations has been misread; and the earliest proof of rice farming in information comes from Chopani Mando in Belan valley to the South of Allahabad flanked by Tons and Son rivers.

Another location of significance is Chirand situated in Bihar on the plains of the river Ganga. This location has been assessed for its closing era as "modern with the Late Harappan" through Bridget and Alchin. The occupants existed in huts made of bamboo and strengthened with mud-plaster. Proof for rice farming in the form of rice husks has become available from this location. Since fish bones have also been establish beside with rice husks it may be assumed that rice and fish shaped a main food thing the inhabitants.

Peninsular India

The proof for early agriculture in this part of the country comes mainly from locations exhumed in the Karnataka region. These locations are commonly recognized as 'Ash-mounds' and are situated at Utnur, Kupgal, Kodekal and Pallavoy. It is suggested that no outside power worked in the development of these locations and they had an impulse of their own in developing a Neolithic civilization. The geographical peculiarities of the region where these locations are situated have been described through Bridget and Allchin: "In that part of the Deccan plateau where this new pattern first urbanized, the predominant physical characteristics are residual granite hills rising from a rolling 'sea' of black cotton soil. The hills were favored for resolution, and wherever they contained appropriate caves or rock shelters, these were used for environment, and often enlarged through the construction of a leveled stone terrace in front. Little plateau on the summits of hills or stage regions on hillsides were likewise exploited and artificially leveled or

extended. In some cases there appear to have been single big terraces, while in others there were several little ones, rising one behind the other up the slope of a hill. At this early era, locations are only rarely establish on the banks of rivers absent from hills. There is as yet no proof for structures associated with the earliest settlements in this region".

Interestingly the 'Ash-mound' locations have been establish to be modern with the early stage of Harappan civilization. The mainly notable characteristic here is the subsistence of cattle-pens where domesticated cattle like sheep and goats were kept penned jointly. "These pens were bounded through two heavy stockades of palm-trunks. The inner of the two provided the region in which the cattle were penned, while the outer provided a legroom within which the herdsmen existed". We have not establish any direct proof of agriculture in the form of granules from these spaces. But the availability of apparatus such as rubbing stones, querns and ground axes suggests that farming was practiced.

RIVER VALLEY CIVILIZATION

The Antecedents

The flood-plains of rivers supporting agriculture has been a typical environmental action in the Indus region. It gave rise to habitations that sustained on a mix of agricultural and itinerant practices. Some major locations of this kind exhumed in the region are Kili Ghul Muhammad, Rana Ghundai and Mehrgarh. The result of excavation at Mehrgarh has been particularly rewarding. Mehrgarh was an early food-producing village situated 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 location therefore: "The Bolan River gives a major route of communication flanked by the Indus Valley and Baluchistan. It is the principal hydrological characteristic of the Kachi Plain today where it runs beside 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 lay, at the base of this route, presently off the central plain of the Indus River. This is an

extremely significant, special site; a hub of communication, a lay where peoples met and mixed." It is clear that the richness of material proof from Mehrgarh is perfectly in tune with its situational importance. We shall look at the proof from this location to understand the background of Indus valley agriculture.

Mehrgarh is a unique location as it gives proof from almost 'every stage of the Neolithic Revolution' extending roughly from 7000 BC to 3800 BC. Settlements at Mehrgarh have been establish spread approximately in a row. The overlap is absent as the settlers moved from one lay to another beside the Bolan River. This movement was from North to South with three separate eras -I, II and III - of resolution noticeable. As stated through Possehl "A great deal of information on the paleobotany of Mehrgarh is available. The collection from Era I am especially rich. The dominant plant of Era I is domesticated, naked six-line barley. There are two other diversities of domesticated barley as well. Domesticated wheat is present in the form of einkorn, emmer and a free threshing hard durum, but in amounts much smaller than the barley example. The non-cereals so distant recognized for the era contain the Indian jujube and dates, represented through stones in Era 1 and II". It is therefore apparent that the beginning of the Indus civilization was marked through an already existing organization of agriculture at permanent settlements in the river valleys of the region.

The Environmental Circumstances

An understanding of the environmental circumstances in the Indus region is of importance because the region today falls in a semi-arid zone and may perhaps not sustain agriculture in the similar measure in which archaeological proof gives a testimony. The revise of environmental circumstances in the Indus region has evoked some debate as to dissimilar climatic circumstances obtaining at the time of the flourish of Indus civilization. We discover it worthwhile to at least outline the contours of this debate to help us understand more clearly the environmental setting in which the agricultural growths in Indus civilization took lay.

"Based on the job pioneered through Sir Aural Stein and the writings of V. Gordon Childe", says Possehl, "it was once idea that all of the Close to East and the Western parts of South Asia had been subjected to severe post-Pleistocene desiccation. The attendance of stone dams described *gabarbands* and big numbers of prehistoric archaeological locations in regions now approximately devoid of settled peoples seemed to fit such a hypothesis". This view gave rise to the belief that arid environmental condition in this region was the consequence of an exploitative human action that denuded the region of its natural possessions contrary to the view that severe climatic fluctuations caused the degradation. Subsequently three studies focusing on climatic circumstances of Indus civilization appeared flanked by 1961 and 1971 which extended the discussion further. The first, in time sequence, was a revise undertaken jointly through Robert L. Raikes and Robert H. Dyson, Jr. They reexamined "the arguments and proof 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 difference but was the result of human action of degrading nature in excess of an extensive era of time. The two other studies are through Gurdip Singh and through C. Ramaswamy. Gurdip Singh's revise 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 in relation to the 2000 BC increased the salinity of these lakes; through implication so the similar aridity affected the Indus region.

Ramaswamy puts forward the case for climatic difference rather directly. He says that there is adequate archaeological proof to suggest that the Harappans, who flourished in the Indus Valley flanked by 2500 and 1700 ± 100 BC, existed in climatic circumstances that were much moister than the circumstances that exist in the region today. "These conclusions" he asserts "are further supported through the recent detection of considerable reserves of ground water in the arid region of extreme West Rajasthan secure to the Indus Valley. Carbon - 14 tests accepted out through staff of the Tata Institute of Fundamental Research in Bombay, at a lay described Palana, 14 miles South of Bikaner indicates that the ground water there is in relation to the 5,000 -

year old, this being the upper limit of the true age of the water". The issue was subjected to a scrutiny in later years. It has now been establish that the three studies do not provide clinching proof in support of the view that there indeed has been a marked climatic shift in the region since the days of Indus civilization. Irfan Habib asserts that the climatic - shift view is "inconsistent with the drainage organization at Mohenjo Daro and Kalibangan which could not have withstood any heavier rainfall than what the region now receives. If an 'arid' stage really followed a 'wet' stage in the present geological age, then the change necessity have extensive preceded the Indus civilization".

Likewise, for Gurdip Singh's revise Possehl writes: "The changing salinity of these lakes, which appears to be well documented, require not be attributed to changes in rainfall. The geology of Rajashan is intricate. The three lakes investigated are hypersaline today, but there are also fresh water lakes in this similar region. 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". It can now be safely contended that on the whole there has been no important shift in climate in the Indus region. The region has remained semi-arid since the beginning of the Indus Civilization with inadequate rainfall so as not to support agriculture without the assistance of supplementary irrigation. The flood-plain agriculture of the Indus civilization was feature of the climatic circumstances and the peculiar behaviour of seasonal floods in the rivers.

Indus Agriculture

The information that it sustained the development of such a significant civilization is in itself adequate proof of these potentialities. Irfan Habib has attempted an estimation of the population of the Indus civilization to illustrate the number that existed on Indus agriculture we reproduce his motivating explanation below: "The number of inhabitants that this big region 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 in relation to the 150,000 persons assignable to Mohenjo Daro and

Harappa jointly, the total urban population could not have been less than 250,000, bearing in mind the information that big urban locations like Ganweriwala in Bahawalpur and Lakhmirwala in the Indian Punjab still remain unexcavated. At the height of de-urbanisation in India throughout the nineteenth century, the rural population was almost nine times the urban. With a much lower stage of agricultural productivity than in the nineteenth century, it will be hard to assume that enough food for the urban population was grown in the Indus civilization through a rural population less than fifteen times its number. Such a ratio would provide a total population of four million for the whole territory of the Indus civilization, or almost six persons per square kilometer. This would compare with almost 50 persons per square kilometer in the similar region in 1901. The comparison helps us to see how sparsely populated the Indus basin necessity still have been at the time of the Indus civilization".

How such an augment in agricultural manufacture was achieved does no more remain a puzzle if we cautiously look at the method of agriculture and the apparatus etc. used for the purpose. We have already ruled out the tentative suggestions that climate was more favorable then than it has been now. Advanced agricultural apparatus and a more organized method appear to be more likely factors influencing agricultural manufacture.

Method and Apparatus

In a region which did not have enough rainfall for supporting agriculture recourse was taken to the flood-plains of the rivers which had the tendency of depositing every year soft and fertile alluvial soil beside their banks throughout the summer months. The agricultural pattern of Indus civilization was therefore geared accordingly and it is useful to understand the river behaviour at some length to truly appreciate this characteristic. The Indus has an extremely big and wide flood plain and the alluvium deposit too is fairly deep. In information the behaviour of Indus is comparable with the two other river systems that were also the cradle of significant ancient civilization - the Nile and the Euphrates - Tigris river systems. A comparison of this kind may help us lay the Indus organization in proper perspective. A comparison of

Indus with Nile and Euphrates - Tigris has been done through Shereen Ratnagar. She writes: “The Nile is, in contrast, predictable and tame. It floods its very narrow valley flanked by late June and September with a fair degree of regularity, the water standing in the meadows for many 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 stage in August. But its annual water discharge is 207 billion cubic metres as against the 63 billion cubic metres of the Nile. Its catchments in the Himalaya are many times the magnitude of the Nile or Euphrates catchments, and it carries a vast amount of water at great speed”. The flood plains of Indus, as is apparent, 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 civilization. Shereen Ratnagar is quite perceptive when she says, “The sites of Harappan locations are not totally explained through climatic circumstances. In information rainfall, as in all arid regions of the world, is erratic - variability in Sind, for instance, 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 regions with reliable possessions - i.e. those annually inundated or, more significant, with perennial springs or lakes or sweet-water wells secure to the surface - rather than in regions 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”.

The significant proof on agricultural apparatus comes from Kalibangan, Banwali, Jawaiwala and Shortughai. Two ploughed meadows have been exposed through archaeologists from Kalibangan and from the Indus resolution at Shortughai. The locations at Banwali and Jawaiwala have provided proof relating to plough as an agricultural tool. The detection 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 through asserting that the "plough greatly lessened the labour of peasants previously performing the similar task manually with the hoe, and also enabled the similar family to till a much superior region of land. It accordingly brought in relation to the substantial augment in yield per head of population".

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 through September or so. Wheat and barley were two main crops for which proof was already there in Mehrgarh - they sustained in the Indus civilization. The other *rabi* crops, for which proof has approach from Indus era locations, were mustard, linseed, peas, lentil, gram. If not everywhere, at least in some localized lay millets - grown in summers, and also rice have also been accounted. Shereen Ratnagar writes:

- "Available proof designates that rice 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 recognized 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 era but ragi was perhaps being grown approximately this time in Saurashtra and Kutch".

The other proof for crops is for date-seeds and grape-seeds and *ber* from Rohira and a species of vetches from Balakot. Though no direct proof for cotton has been establish it can be presumed that the crop that appeared approximately 4000 BC sustained to be grown throughout the Indus civilization. There is some more related information that adds to our understanding of Indus agriculture. Irfan Habib refers to a motivating proof as he says, "Ovens, including tandoors, have been establish at Kalibangan, taking the history of bread-creation in India back to almost 5,000 years ago".

Likewise the use of fibre and oil extracted from cotton and sesame has been deduced through Shereen Ratnagar. She also suggests that “oil from linseed would have been used for lamps rather than for food”.

AGRICULTURAL DIFFUSION AND REGIONALSPECIFICITIES

Geography and Survival Strategies

The possibilities of agriculture, it spread and regional variations in early India were dependent on geography to a considerable extent. The status of farming in early India ranged from shifting farming to slash and burn to swidden to hoe to plough farming. 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 procedure of urbanisation supported through a flourishing hinterland was also uneven. While the first urbanisation in the Indus organization is dated to the second half of third millennium BC and the second urbanisation in the Ganges organization to the first millennium BC, the plains of Brahmaputra witnessed such growths at a later stage. Pre-circumstances of agricultural development like land clearance was constrained through 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 level.

Not all the regions within Northern plains were as fertile as the Gangetic region. So intricate civilizations could be sustained in the middle Gangetic plains and Eastern India. Here wet-rice farming acquiesced higher surplus. The rain-fed agriculture in the northwest was utilized to produce wheat and barley. The drier regions normally practiced cattle breeding. Western Rajasthan, the region of Thar Desert, hardly permitted circumstances of farming. Caravan traders frequented the desert and subsequently the trading centres grew in the region. Though, with the development of irrigation facilities some of the sub-regions in Rajasthan began to be cultivated. In

contrast, the regions in the Northeast, Bengal and Orissa benefited from the blowing of the Northeast monsoon from December to February. These regions received plenty of rain and were hence blessed with thick vegetation. Though it is hard 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 remnants and soil belonging to the post-Harappan era in the Northwest point to rising aridity.

The variations in the resolution patterns and forests were often guided through climatic circumstances. In the drier regions villages were usually nucleated. Meadows bounded the settlements and pastures were situated distant absent. In the wetter, rice-rising eastern India linear homesteads were the norm. As distant as forests are concerned, the range incorporated extensive rain forests of the wetter regions 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 establish. Soil kinds have been the other significant factor, which has decided the agricultural viability of dissimilar 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 site is hazardous. In relatively elevated regions deep ploughing is required. The use of ploughshare, iron in the north and wood in the peninsular region and its consequences for the agriculture has been debated in the middle of historians rather animatedly.

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

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

Early Indian literature describes *Pulindas, Nishadas* and *Sabaras* as demonic figures relegated to the strange, unpredictable wilderness. As described in the *Mahabharata*, the procedure of burning of *Khandava vana* for the resolution of Indraprastha destroyed several such demonic creatures beside with animals and human beings. These forests and their inhabitants were juxtaposed to the predictable world of plough agriculturists. Though, the vana/aranya and ksetra/janapada were neither homogenous nor immutable spaces. The perceived opposition flanked by 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 survival behaviors were alike to those of their neighbouring peasants. Even the tribal settlements could change into peasant villages. So the forest dwellers were not essentially hunter-gatherers. They practiced shifting farming or horticulture or even sedentary farming. The images of forests, which were seen as house to demonic creatures earlier, came to be romanticized later. These were preferred through ascetics and seemed an ideal site for establishment of hermitages. Clearance of the forests to extend cultivable land did not cause enough damage to vegetation till the population was little but in the past few centuries it has sustained unabated resulting in the depletion of forest cover. *Arthashastra* of Kautilya recommended strict state manage in excess of forest clearance, perhaps to check in excess of-use.

The Aftermath of Harappan Civilization

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

Post-urban Harappan Situation

The post-urban Indus region was marked through many cultures. In the North West Boundary Province (NWFP) is establish Swat Civilization 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, locations like Sibri and Pirak testify the farming of *rabi* and *kharif* crops. *Rabi* crops contain wheat (bread and shot), barley (six-rowed diversities), oats, chickpea and linseed while rice, millets *(jowar* and *cheena*) were the principal *kharif* crops establish beside with grapes. Goat, sheep and humped bull were being domesticated. The Jhukar Civilization, spread in excess of Jhukar (north of Mohenjodaro), Chanhudaro, Amri and Mohenjodaro itself consisted of extremely few settlements and does not give us with evidences pertaining to farming of crops. In the Cemetery-H Civilization exposed at Harappa, rice and finger millet (*ragi*) were introduced in this era.

At a location 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 establish. The increased number of settlements in Punjab (on the Indian face), Haryana and Northwestern Uttar Pradesh might have resulted from migration of some societies 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 farming. Rice farming in era II-A beside with millet, bajra or bulrush millet (*Pennisetum typhoideum*) in era III is obtained at Rangpur. A arid forest and a dissimilar climate lived in the region. This is indicated through identification of the trees of acacias, tamarisk and albizzia. At Rojdi, a location belonging to Gujarat, *kharif* crops including millets (*ragi, bajra, jowar*) and *rabi* represented through the lentil and pea have been exposed. Though, rice is not accounted.

Agro-pastoralism in Chalcolithic Cultures

Outside the Indus (Harappan) region a big number of hunter-gatherers, pastoralists and farmers lived. It is hard to ascertain the Harappan power on their lives. Some changes in the pattern of crop combination and the agricultural practices in the Neolithic-Chalcolithic era are discernible. Rice has been accounted from the valley of Swat. Here, the detection of a little 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 face of the furrow. Some locations dated to 3rd and 2nd millennium BC at Burzahom and Gufkral (Kashmir) were by sickle shaped implements for harvesting grain. Such implements are also exposed from Central Asia. Rice also occurs at Ahar in Rajasthan, upper Gangetic valley, Chirand in Bihar, Orissa and the further East, perhaps in Northeast and at a later date at Malwa. Wheat and Barley have been accounted from Balathal in Southeast Rajasthan and appear as dominant crops in Malwa. Millets, usually cultivated in the South are represented in Balathal too. It has been suggested that the social pattern of the wheat rising region was not as intricate as of those cultivating rice.

In central India and Rajasthan many chalcolithic locations have been investigated. Of these, mention may be made of Kayatha civilization in the Chambal Valley, Dangwada in Ujjain and Ahar in Rajasthan. The location of Kayatha brings out the proof of farming of Indian jujube, two types of wheat (*Triticum sphaerococcum* and *Triticum compactum*) and seeds of horse gram. Faunal remnants of bovine species and tortoise are also accounted. Though five-fold cultural sequences spanning from Chalcolithic to early medieval times are exposed at Dangwada, the location context of material remnants of the early era have not been satisfactorily understood. Though, lentil, rice, horse gram and Indian jujube dated to Sunga and Gupta era are establish. Ahar or Banas civilization is situated east to the Udaipur city in Rajasthan. The revise of the chalcolithic layers points out to a possibility of a mixed economy. Here, agriculture and animal herding coexisted with hunting and fishing. Many impressions on the pottery sherds indicate to the farming of rice and millet. Vishnu-Mittre suggested that the factual history of millet was attested

for the first time in the Ahar material civilization. Sorghum, perhaps *bajra* or bulrush millet was also cultivated. The locations abound in faunal remnants pertaining to turtles, fish, goat, sheep, deer, pig and cattle.

In the Gangetic plains, the peasant, unlike the Indus civilization, was no longer confined to the narrow strips of flood lands enriched through fresh doses of moisture and silt. The generosity of monsoons allowed him to augment the yield through shifting to new reclaimed virgin lands from forests. Many chalcolithic cultures like OCP (Ochre Coloured Pottery), BRW(Black & Red Ware), PGW(Painted Grey Ware) help us to understand the connection flanked by environment and crop pattern. The locations of OCP civilization were usually situated on the riverbanks. Such locations are spread in excess of eastern Punjab, western UP and eastern Rajasthan. Atranjikhera, one of the significant exhumed locations, remained flooded or water logged for a considerable era of time. The list of crops at Atranjikhera comprises two cereals– rice (*oryza sativa L, lathyrus sativus L*) and barley (*hordeum vulgare L*), and two pulses – gram (hulled and six-line 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 farming of gram was perhaps the oldest record of its farming in India. *Khesri* was grown as a weed on dehydrated up paddy meadows. Both these pulses shared sure similarities; required little amount of water, cultivated as winter crops and belonged to legume family. These factors enhanced the fertility of the soil.

BRW civilization is establish in the upper Ganga-Yamuna and middle Gangetic Doab. Some of the significant locations contain Atranjikhera, Noh, Jodhpura and Narhan. At Atranjikhera, the crop pattern is basically alike to the OCP stages. At Noh rice impressions beside with *urad* and kidney shaped seed of horse gram have been accounted. The *oryza sativa* diversity of rice is establish from impressions at Jodhpura. At Narhan, one discovers a well-urbanized agricultural regime. Hulled and six-line barley, rice (*oryza sativa*), club and bread wheat, mustard seeds, linseed and pulses (pea, *moong*, chickpea and *khesri*) are the main crops exposed here. The locations of PGW civilization are situated in Western UP, Punjab, Haryana and Northern

Rajasthan. These locations were on riverbanks and the inhabitants utilised both the cultivable plains and pastures. A sickle and hoe has been accounted from Jakhera. The breeding of cow, buffalo, pig, goat, sheep and horse is indicated from the faunal remnants. Wheat, barley and rice have been exposed at Atranjikhera. The farming of wheat through PGW people (wheat requires water supply at regular intervals) has led K.A. Chowdhury to speculate on the possibility of irrigation in the era.

Survival in Transition: 'Pastoralism to Agriculture' in Vedic Corpus

Archaeological cultures give enough proof concerning agricultural practices and crop pattern. The Vedic corpus, though, map a transition from a pastoralist to an agriculturist civilization. The literary construct of 'eastward migration' of Indo-Aryan speakers from Punjab to western Ganges plain and further East is being increasingly challenged. Though, 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 usually wetter. Some regions of the Punjab were semi-arid and hence more conducive to rustic behaviors. The migration of the Vedic people to the Gangetic plain was through Himalayan foothills as it was hard to cut paths crossways more thick forests in the plains. Communication was possible crossways rivers of the Ganges organization.

Rigveda is replete with references indicating the attendance of a predominantly pastoralist civilization. Many linguistic expressions denote the usefulness of cow in this era. In the absence of landed economy, cow was treated as a scarce resource and hence became an substance of veneration. Also, the Rig Vedic people occupied in cattle raids, fought in excess of grazing grounds and manages of river water. Herd owning clans could use general pastures. Another animal, horse rose to prominence in this era as cows could be herded from horse back to vast pastures. It also helped in cattle-plunder behaviors. Agriculture in the Sapta-Sindhu (land of the seven rivers) region was mainly used to produce fodder. The use of wooden ploughshare through the pre-existing civilizations is also not ruled out. In information, the antiquity of plough is drawn to pre-Harappan times and Indo-Aryans borrowed

languages 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 region in the western UP was marked through the use of iron implements and 'six to twenty-four oxen' yoked to the plough. Though this appears to be an exaggeration, plough definitely became a symbol of power and fertility. Although the later Vedic texts speak of iron, agricultural implements have not been satisfactorily exposed. Rice and wheat began to be cultivated beside with already cultivated barley. It is postulated that the dominant rustic chiefs acted as administrator protector of regional agriculturists. Pastoralists and agriculturists shared a symbiotic connection as the agriculturists made available post harvest stubble for the herds to feed on. The animal droppings could manure the meadows. Also, pastoralists did not stick to one lay for extensive and acted as periodic carriers of products of swap.

The transition from chalcolithic to the NBPW (Norther Black Polished Ware)/ early historic era in the upper Gangetic plains was marked through growth in number of locations, enhanced resolution size and augment in geographical extent of inhabited region. Within the NBPW civilization environment spread from well-drained region absent from lakes and rivers to the mainly unfriendly regions. Some of the regions like Mathura remained rustic for centuries because the soil was not conducive for the growth of agriculture. In contrast, the middle Gangetic plains did not have resolution groups or nucleated villages before 500 BC. The NBPW (also recognized as deluxe pottery) civilization marks the arrival of sedentary peasant farming. This is testified through proof related to farming of diversities of rice (including the transplanted) and plough farming etc., resulting in high yield. The proliferation of settlements in this era is attributed to wet – rice farming and its increased yield.

Second Urbanisation and Intricate State Civilizations

The procedure of urbanisation in early historic India presupposes the support of a wealthy hinterland. The environmental circumstances 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 measured as the significant bases of urbanisation. The forces unleashed through these socio-economic changes created favorable circumstances for the arrival of intricate state civilizations.

The Environmental Setting

The centres of second urbanisation, situated in the dissimilar 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 general factors of soil fertility and higher agricultural potential. Tamra Nala and Lundi Nala watered Taxila. The Northeastern valley was house to Buddhist monasteries and is today well-known for citrus orchards. Buddhist monasteries were also situated in Charsada through which flowed the Kabul and Swat rivers. Kandhar is recognized as the oasis municipality on the Eastern face of Dasht-i-Margo, the desert basin of Helmund River. The central Ganges plains are an region of monsoon climate and big forest trees can be establish here. As one traverses eastwards, two characteristics change: steady augment in rainfall and humidity and the replacement of the open grazing grassy lands through the paddy meadows. Diversities of alluvium could be utilized at dissimilar times and in dissimilar climatic circumstances. Settlements in the older alluvium were regularly recognized. 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 alike 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 foundation of a revise of resolution patterns of Kathiawad, it has been suggested that the region practiced flourishing farming in the early historic era.

Iron and Rice: The Causative Mediators

The rise of second urbanisation and intricate state civilizations in the first millennium has been connected to transformative potential of iron technology and wet-rice farming. It is suggested that these two elements facilitated the augment in carrying capability of the land and helped in sustaining urban centres. Urbanism seen in its several dimensions viz., proliferation of settlements, arts and crafts was inextricably connected to the new methods of farming 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 incorporated the alluvial strip of river valleys but also the heavier, extensive stretches of black cotton soil. Though, the amenability of the black cotton soil to heavy iron-tipped plough is recognized. The factor of rice, as we shall see, is also a vexed issue. As distant as the crop pattern is concerned, the vital list remnants the similar from the BRW to NBPW stage. Also, the Doab region was already being exploited in the PGW stage. The inhabited resolution region rose through 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 several stages of use of iron in early India. Up to 700-600 BC, the locations of Kausambi, Hastinapur and Atranjikhera illustrate that the agricultural productivity remained low and the economy was marked through a combination of hunting, animal husbandry and agriculture. Though, except for stray discoveries of cutting apparatus like sickle and axe no agricultural implements have been establish. Land was either cultivated through wooden ploughshare or it may have been of marginal significance. It is remarked that the meadows 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 era flanked by 700/600 BC- 1st Century AD is characterized as middle iron stage. Some of the locations in this era were situated close to raw-material rich regions. 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 accounted.

Though, as represented at the location of Rajghat, animal husbandry, both the drought and much animals was still in vogue. The emergence of historical era in the first millennium BC/AD definitely ushered in an period of agricultural implements.

It can be suggested that the farming implements were virtually absent in the early stage though the procedure of colonization and use of riverine regions had already begun. Also, the locations such as Pirak would illustrate that mere attendance of iron apparatus in the location 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 intricate state civilizations in the 1st millennium should not be attributed to the single factor of iron.

Manifestations of wide diversities of rice farming in archaeology and literature and the significance it acquired in Indian rituals underline its antiquity. Archaeologists have argued in favor 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 proof of rice-farming 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 diversity began to be cultivated in the middle Gangetic valley only. It was a well-recognized practice through the beginning of the early historic era. The enhancement of yield under transplanted diversity is an undeniable information. Whether this diversity beside with other variables had a direct bearing on rise of intricate state civilizations is still being debated.

Early India: Irrigation, Reclamation and Phased Formations

The nature of attendance of a pan-Indian polity or an empire in early India has aroused lot of interest in the middle of scholars. Attempts have been made to redefine the term 'empire' in this context. It is now widely held that Mauryan Empire consisted of several variegated peripheral regions and so there could not have been uniformity in survival strategies. The procedure of

reclamation in early India necessitated the construction of viable irrigation mechanisms. Since the regions were uneven because of their environmental characteristics and convergence of historical forces, the agricultural regions appeared in a phased manner.

Irrigation Patterns in Early India: The Construct of Hydraulic Despotism

The variations in the irrigation organization in early India depended on scrupulous environment, acreage of land under farming and the sponsoring agent- the state, societies or individual. In other languages, natural circumstances and the manage mechanism determined the kind of irrigation. It could range from easy channels diverted from river or natural streams, water-bailing machines, pot-fitted wheels attached to the wells to urbanized technologies like Persian wheels, hillside channels watering terraced meadows, canals, big reservoirs, tanks and embankments. The availability of water possessions 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 manners of water supply as:

- *Hastaprayartima*- drawing water with hands and carrying it to the meadows in the pitchers;
- *Skanda*- carrying water on the shoulders or the neck of the bullocks;
- *Srotyantra*- a mechanism for lifting water in channels flowing in to the meadows; and
- *Udghatam*- the water wheel for raising water from river, etc.

There is no dearth of literary references pertaining to irrigation in the Mauryan era. Archaeological excavations attest the attendance of many terracotta ring wells at Hastinapur, New Delhi, Ropar, Ujjain and Nasik. These have also been accounted in Eastern UP and Bihar. Although not all of them were used for irrigation purposes, there is proof that the water from brick well at Ujjain irrigated the meadows. Several tanks (including the votive ones) have been exposed at Taxila, Hastinapur, Udaipur, Ahicchatra (in Bareilly),

Kausambi and Bhita. A number of tanks establish at Mathura were also being used for irrigation. What is noteworthy in relation to the these tanks and wells is that these were mostly situated in regions where irrigation was necessary. In comparison, there was a relative paucity of wells, tanks and canals in the central Gangetic plains. There was common augment in the number of wells in the post-Mauryan era notwithstanding the decline in the number of ring wells. The significance attached to artificial irrigation underwent a change throughout state- formation. Here, the causes more than cause of survival 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 urbanized 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. Likewise, king Kharvela extended an old canal in Kalinga. At Besnagar in Madhya Pradesh is establish an old canal. The Bes River was situated in relation to the 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 dehydrated up in the summer. As distant as the role of state is concerned, some of the irrigation sources necessitated state's initiatives. The initial outlay of the canal required vast expenses and hence was beyond the means of individuals and societies. They could build relatively less expensive tanks but these tanks could not irrigate big regions.

It was only with the publication of Karl A. Wittfogel's job on "Oriental Despotism" that the studies on water possessions and it's relation with the state gained impetus. Wittfogel proposed that the requirement of big-level irrigation in arid or semiarid region led to an enormous hydraulic organisation, which in course of time became the source of agro-hydraulic despotism. Organizational shapes urbanized 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 organization 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 generalization' in order to explain variations from his ideal model. Difference, just as to him occurred due to the region and its relation to marginal and sub-marginal regions. Property rights, which were weak in a hydraulic state, also shaped the foundation of difference, viz.

- Easy,
- Semi complex and
- Intricate.

Indian case was picked up as a semi-intricate model. The relation with the state determined class location in such a civilization. The ruled did not participate in the state procedure. 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 civilizations urbanized in semi-arid regions because these could be irrigated through inundations, while humid regions sheltered 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 big one. The repair of the embankment of the Sudarsana Lake through the governors under the Mauryans, Rudradaman and the Guptas designates that irrigation was also a provincial responsibility. In the post- Mauryan era, the state usually ceased to bear the main responsibility for irrigation. The rulers undertook occasional levies from the peasants to accomplish the job. It has been suggested that hydro-agriculture was better suited to India. Kautilya preferred little-level irrigation. Kautilya, while enumerating dissimilar kinds of irrigated lands perhaps makes mention of a channel from a tank or dam rather than a canal. Even the canals were too little for big-level irrigation. Wittfogel ignored the role of technology. He did not

visualize the thrash about 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 farming to wasteland rather than artificial irrigation.

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

In the post-Mauryan era, the epicenter shifted from the Gangetic regions to the peripheries. New centres of power appeared. Through the 3rd Century AD big parts of the Himalayan zone, Assam, West Bengal, Orissa, Eastern MP, Rajasthan and Gujarat did enter the historical stage. The bases of state formation in Gupta and post-Gupta era can be situated in diffusion of iron technology, plough agriculture and the role played through the *Brahmana* migrants. State formation in the hills of Punjab took lay only in this era. At least 48 kingdoms lived in the mainly forested red soil regions of Maharashtra, Eastern MP, AP, Orissa and Bengal. It has been remarked that the spread into dissimilar regions was not without disagreement.

Agrarian expansion and reclamation pattern mainly depended on the nature of land endowments in the early medieval era. The traditional wisdom of *Brahmanas* concerning rainy season, sowing season etc., and the knowledge of recognized practices of agriculture was diffused in dissimilar regions. The preservation of cattle wealth espoused through Brahmanic ideals helped agrarian economy. Many texts dealing with agricultural knowledge began to be translated in the vernaculars. An significant instance of the diffusion can be seen in a 9th century inscription from the Ajmer region. The term *brhadhala* mentioned in the inscription means big plough, which could have helped in breaking hard soil, and make it pliable. Pounders were used in Bengal under the Palas. As these growths indicate, sub-regional agrarian bases urbanized in the post-Gupta era. The procedure of agrarian expansion sustained unabated and the 6th-9th centuries AD were marked through emergence of agricultural regions. Bengal under Palas and Senas, Orissa under Somavamsis and later Gangas are cases in point.

Through the early medieval era dissimilar manners of water supply came to be associated with dissimilar regions. Western India was

characterized through 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 utilization of these water bodies necessitated the organisation of supra-village organisation and in course of time could make nodal points in the rural legroom. Though, not all the regions witnessed uniform pattern of reclamation. In Bengal deltaic regions were also colonized. In the regions like Rajasthan, Gujarat and Maharashtra land endowments were made in the waste regions. The transfer of privileges and sure rights to the beneficiaries of these endowments posited them in an advantageous location vis-à-vis the ranks of peasantry. Though, in the Brahmaputra valley the land endowments were situated in already reclaimed regions. In information, core of the valley was reclaimed before the onset of early medieval era. Limited practice of wet –rice farming through the Kachari people is apparent from the epigraphic conditions and ethnographic literature on pre-contemporary irrigation in the valley. Reclamation in the hilly fringes of the valley sustained till the 19th century AD.

Situation In Medieval Era

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

Crop-patterns: Stability and Change

In the medieval era, the Sultanate rulers may not have directly promoted agrarian expansion unlike early India. Though, their interest in the land-revenue organization is undeniable and it had an indirect bearing on agricultural manufacture. The imperial dominion consisted of big regions of

alluvium soil. There were though sure exceptions like Siwalik Hills due northwards or the broken Aravalli ranges in the South–West of Delhi. As demonstrated in *Baburnama*, the arid 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, though little, had a definite bearing on crops harvested. While usually 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 distant as crop patterns are concerned, the situation in the medieval era sustained to be the similar 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 almost certainly introduced in the 17th century AD. Cotton was extensively cultivated beside with inferior crops like *bajra* ('diet of the poor') barley and sesame. Some of the crops came to be cultivated on a much wider level. Wide level farming of poppy might not have taken lay 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 farming of fruits also received attention of the medieval rulers. Pomegranates are specially referred to. Jodhpur dedicated in its farming and even the Persian diversities were no match to these. Rulers like Muhammad Tughlaq and Firuz Tughlaq are credited for developing a big number of gardens in and approximately Delhi and Chittor. Grapes received special attention in these gardens. These orchards though produced mainly for the cities and the elites. Portuguese are credited with introducing tobacco and also some fruits in India. These contain papaya, cashew nuts and pineapple. Coffee was also introduced in this era.

State Intervention and Regional Variations

The region under farming considerably increased under the Sultanate and the Mughal rulers. Throughout the Sultanate era the route to Delhi was mainly 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 region began to be cultivated. Regions of Multan district, an arid waste region were colonized under Ainul-Mulk Mahru. Many canals and water channels were constructed here. Subsequently, the manufacture of the region doubled. Firuz Tughlaq contributed considerably to construction of an extensive organization of canals. The canals from Yamuna, Sutlej and Ghaggar watered the regions of Hissar in Haryana. In Sind and Punjab, the canals were relatively smaller but contributed to growth of agriculture. Just as to estimates worked out through historians, extension of farming approximately doubled from 16th to the beginning of 20th century AD. The clearance of forests and agrarian expansion sustained in Bihar, Bengal and Awadh. The practice of constructing canals sustained under Mughals also but it is suggested that owing to their low stage 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 farming. Though, farming was predominantly shifting in nature besides gathering (of fruits, roots and herbs) and hunting-fishing behaviors. The survival 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 whispered they came to the valley in search of cultivable land. They subjugated the regional tribes and recognized themselves in the extreme southeastern part of the valley. Ahoms originally belonged to Mongolia, China and are credited to have introduced wet-rice farming on a wider level in the Brahmaputra valley. Modern chroniclers noted sub-regional variations within Assam. Mughal chronicler Shihabuddin Talish remarked that even the foreigners were attracted through the flourishing wet-rice farming in Brahmaputra valley. On the other hand, Ralph Fitch in 1585 noted only the farming of silk, bamboo, cotton, cane etc., in the lower Assam. Compared to the valley, the hills practiced primitive methods of rice farming besides hunting and gathering behaviors. With little modifications the variations still exist.

Pre-Iron Age Situation

The earliest pre-Iron Age agricultural settlements in the peninsular India were situated in the semi-arid regions where agricultural farming 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 through a diversity of sustenance factors like millet farming, cattle and sheep pastoralism and hunting of wild animals, it can be described as an agro-rustic economy. Ecology had significant bearing on proto-historic growths, which were marked either through agrarian growth or lack of it. The first Chalcolithic cultures were establish in the western and southern Deccan. In the region of Andhra a few well-documented locations like Nagarjunakonda and Kesarapalli are situated in the coastal plains while the unusual location of Chagtur is situated in the Mahbubnagar district of Telengana plateau.

Three-fold Classification

Bridget and Raymond Allchin, on the foundation of the exhumed locations give 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 approximately 2500-1800 B.C., cattle husbandry played an significant role. Here, ash mounds or cattle pens have been exposed. Though, the attendance of rubbing stones and querns at earliest stages indicates the processing of grain for food. These settlements were situated on the top of granite hills or on levelled terraces or in the valleys flanked by hills. The site of the settlements in the intermediate era sustained to be more or less the similar. The significant locations for this era contain Piklihal, Brahmagiri, Sanganakallu I, Tekkalakota I, Hallur IIa and T.Narsipur. The third stage comprises the locations of Tekkalakota II, Hallur (layers 8-9), Piklihal, Sanganakallu 1.2, Brahmagiri and Paiyampalli. While metals like copper or bronze were not

establish at some of these locations in the earliest stage, 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 absent from major watersheds. The soil kinds in the settlements incorporated tropical black clays, tropical red and black sandy loam, ferruginous tropical soil and deltaic alluvium.

Agro-rustic Economy

The landscape ecology (topographical circumstances, flora, soil variations and rainfall) beside with archaeo-botanical and archaeo-zoological evidences of pre-Iron age settlements indicate the agro-rustic nature of economy. Usually, regions with the potential of rain fed gravity flow irrigation were colonised. This colonization was geared to the farming of millets and pulses. Of animal husbandry, cattle occupied prominence in excess of sheep/goat. Ethno-historical studies have suggested that sheep/goat pastoralism branched off from millet farming-cum- rustic stock. The early farming cultures moved in to the environment of surviving late Mesolithic cultures and interacted with them. At some locations Neolithic-Chalcolithic cultural horizon is establish to have overlapped with the Iron Age civilization.

Chalcolithic Cultures of Deccan

The region of Deccan is not uniform. The several 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 several chalcolithic cultures

like Svalda, Daimabad, Malwa and Jorwe are dated flanked by ca. 2300 B.C. and 900 B.C.

Environmental Variations and Agrarian Specificities

As distant as environment is concerned, the region of Deccan is marked through characteristics such as plateau like morphology, shallow stream valleys, basaltic rocks and chalcedony, agate, chert and jasper (diversities of quartz stone). As the rainfall variability is high, droughts happen regularly. The region abounds in black soil which has moisture retentive minerals. This moisture retentive excellence of soil is seen as a boon for rain fed farming in the semi-arid regions. Except for in the Tapi valley mainly streams have narrow flood plains. High flooding, migrating stream courses and the breaching of natural levees (a natural embankment built up through 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 locations are mostly establish in the Tapi basin. Kaothe is an significant exhumed location of this civilization, where dwelling pits have been establish. In the courtyard of these dwelling pits, deeper pits are establish which were almost certainly used for storing granules. These dwellings also had make-shift kitchens. In the Tapi valley farmsteads have been recognized at several locations. Situated within a aloofness of three kilometers of major locations they lay in proximity to meadows. It is postulated that semi-itinerant Chalcolithic people may have existed and practiced agriculture only throughout a sure season. Here, the proof of crop manufacture reveals farming of *bajra* - pearl millet (Pennisetum typhoids). Usually, 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 civilization also practiced hunting and fishing. The Malwa civilization spread in northern and central parts of Maharashtra in approximately 1700 B.C., primarily in search of fresh pastures. Inamgaon is an significant exhumed location of Malwa civilization. The

survival pattern of Malwa people designates farming of barley besides domestication of animals and hunting of wild games. Jorwe civilization can be measured as a representative Chalcolithic civilization of Maharashtra and is spread in excess of the whole state except for 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 civilization. Though, the concentration of locations in these regions is not uniform. Here, the absence or attendance of black cotton soil has been seen as an significant determinant. As Tapi valley has the mainly fertile topography, highest density of locations is establish 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 sharing and the minimum density.

Several early farming settlements have been establish in the Khandesh region of the Tapi drainage. Though, these are situated mainly on the tributaries than on the main river. Because of erosion and bad land topography, irrigation and rigorous farming is not possible here and so population concentration is not establish 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 superior tracts of black soil. Though, the resolution density in the lower reaches is not as high as in Tapi valley. In Bhima valley except for sure little patches at Chandoli, Songaon, Walki and Inamgaon, the whole of the basin is arid and does not contain big stretches of cultivable soil. Just as to Leshnik, the black cotton soil zone clearly symbolizes an ecological version dictated through available technology, knowledge and means. Except for the location of Walki proof of plough farming is not establish anywhere. It has been suggested that the big fissures that develop in summer in the meadows 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) establish at Inamgaon could also have been used as plough. Perforated stone disc used as weights for digging sticks have been establish. The digging sticks were

useful in burn and slash farming or jhum farming. After the forest was burnt, sowing and planting was done directly in to the ashes.

Crop manufacture and plant economy is better attested in Malwa and Jorwe cultures at Inamgaon and Daimabad in comparison to other locations. 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 and an embankment parallel to it, belonging to Jorwe civilization suggests that it could be used as a narrow water tank and water could be diverted to adjoining meadows through gravity flow. This irrigation channel is supposed to have helped in the farming of wheat and hyacinth bean. The channel almost certainly fell into disuse after BC 1200 or so. Late Jorwe stages illustrate decline of agriculture and rise in the weaning age. At Inamgaon is accounted a rapid decrease of the quantity of charred granules with a simultaneous augment in animal bones.

Survival Pattern

Survival pattern of Chalcolithic cultures in Maharashtra shows some significant characteristics: 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 flanked by 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 village's present proof of early agrarian development, their scope was limited and they could never have an edge technological or economic – in excess of the pastoralists. The Jorwe farmers had to quit agriculture and opt for pastoralism instead.

Archaeology and Literature: Iron/Megalithic Age and Tamil Anthologies

In peninsular India, many locations including those in the Northern Deccan illustrate an overlapping of Neolithic-Chalcolithic cultural horizons with Iron Age stages.

Megalithic Sharing and Typology

Megalithic burials, strewn in approximately the whole peninsula are usually associated with the Iron Age. Though, these are not accounted from western Deccan. In Andhra, Karimnagar has a big number of such burials. Some of the Megalithic locations 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 accounted from the Tamilakam region contain 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 (close to Pondicherry), Suttukkeni (close to Pondicherry), Kadamaliaputtur, Perumbayur, Sanur (Chingleput district) and Amirthamangalam. Megalithic people used diversity of methods for the burial of the dead. These can be classified as sepulchral (pits, chambers, legged, unlegged) and non-sepulchral (commemorative or memorial) kinds. The choice of a scrupulous kind depended on geological suitability and cultural response. Urn burials though widely distributed are quite general in eastern coastal plains. In Malabar Coast laterite little rock cut chambers have been establish. Possessions like water, minerals and arable land influenced such choices and had significant bearing on megalithic settlements.

Agro-rustic Economy

The megalithic burial locations were situated absent from the environment. Also owing to non-sedentary behaviour of the rustic, semi-settled megalithic farmers, proof for big identifiable environment spaces have not been establish. The resource constraint or conflicts with the neighbors seemed to have resulted in short eras of job and sporadic sharing of such locations. McIntosh has attributed the higher frequency of the grave locations in the early era to environmental deterioration and cultural response. Attendance 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 locations have shown proof of remnants of rice, barley, wheat, millet, general pea, lentil, grass pea, horse gram, red gram, Indian jujube, etc.

The nature of survival economy of megalithic people has attracted the attention of a big number of scholars. Megalithic civilization, which shaped the agrarian background to emergence of historical spaces 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 usually attest prolific attendance of iron implements that were related to rising craft manufacture. Though, few locations 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 characterized as settled agrarian, rustic itinerant, rustic and agricultural or semi-sedentary agriculture. It has been suggested through some that this economy was a mixed one with predominance of pastoralism. In information, one can visualize dissimilar survival strategies at job. It was possible that in the early stage pastoralism was dominant and in the later stage irrigated agriculture became more general in the riverine regions and new regions were colonised. Some Scholars have suggested that the megalithic black and red ware custom witnessed population pressure, which coincided with the shift from highland, rustic farming to

deltaic paddy producing plough farming in Andhra and South India in the post-5th century BC.

Tamilakkam, Sangam Literature and the Ecological Concept of Tinai

Early Tamil anthologies or what is commonly recognized as *Sangam* literature contain many strata of Tamil compositions. The earliest and mainly archaic stratum is whispered to belong to Iron Age. The region of *Tamilakkam*, i.e., the region broadly corresponding to contemporary day Tamil Nadu and Kerala, offers possibilities for learning several ecological zones and the natural determinants of manners of survival in the early historical era. The nature of agriculture in the *tinai* ranges from slash and burn farming of hills and forests *(kurinji*) to shifting farming and pastoralism of lower hills and lesser forests *(mullai)* to plough agriculture of riverine regions *(marutam)* to very limited possibilities of arid zones *(palai)* resulting in plundering and hunting behaviors. Many societies 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*) lived in dissimilar and often overlapping ecological segments.

Instead of identifying and literally borrowing the contents of Tamil anthologies, social scientists are increasingly creation attempts at realistic application of the concept of *tinai*. It is hard 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* symbolize micro-eco-zones which overlapped and provided opportunities for interaction. Consequently, macro-zones could be produced. In conditions of human societies and material manufacture overlapping segments were centres of their subsistence. Just as to Rajan Gurukkal, sharing of four shapes of material manufacture namely animal husbandry, shifting farming, petty commodity manufacture and plough agriculture are archaeologically attested but their beginnings cannot be dated.

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 farming. As opposed to this, the agriculturists in the wetland region 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 granules were the general 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 procedure of megalithic economy and their connection with agriculture has been highlighted. Many concepts and conditions 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 behaviors. In order to augment their possessions, the chieftains of *Vanpulam* indulged in plunder behaviors. As compared to resource deprived *Vanpulam* chieftains, the chieftains of *Manpulam* owned big paddy meadows and were wealthy. As is clear from songs and organizations described in *Pura Nanru*, the civilization idealised war and martial ethos. An inevitable and invariable consequence of such plunders was incessant trampling or putting of the paddy meadows on fire. Cultivable meadows were destroyed and the peasants always remained vulnerable to such attacks. Therefore, in the redistributive economy plunders played a important role. Though the civilization 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 foundation. In such a scenario advanced plough agriculture could not spread beyond riverine regions of Kaveri, Vaigai, Tamraparni and Periyar before the early medieval era. Though the technological know-how lived 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 lived as islands in the superior landscapes of *Vanpulam*.

It would be erroneous to assume that these sub-regions remained in accessible and stagnant in excess of time. The interaction flanked by hilly tracts and riverine regions had transforming impact on semi-urbanized or un-urbanized eco-zones though the contradiction within economic infrastructure could not be totally done absent with. The procedure of human version was governed through social and environmental limitations. *Vanpulams* consisted of unfriendly arid and hilly regions besides pastures. Recognized as *enal* or *punam* these abounded in farming of millets and grams. As *Vanpulams* constituted of diverse ecological niches, survival economy could not have been uniform. Pastoralists–agriculturists who were occupied in animal husbandry and arid farming also practiced craft manufacture. Likewise in the riverine regions artisanal categories could be supported through surplus generated from plough agriculture. People in *Vanpulam* depended on *Manpulam* for a diversity of causes viz., job for artisans, exchanging hill products with wetland agrarian products and marginal sections of *Vanpulam* civilization drawing sustenance in one form or other. Some swap centres, *ankaati or avanam* are referred to in Tamil anthologies. Poems in *Pura Nanru* describe the swap roots passing through unfriendly *Vanpulam* tracts. The general medium of swap was paddy and the required commodity was salt. This swap was necessitated through differential access to possessions. Though the degree and volume of foreign deal can be debated, the Tamil region was definitely a part of extensive aloofness swap also. Items obtained from nature including agrarian products were exported from the Tamil land. These incorporated pepper, ginger, cardamom, cloves, aromatics, and wood species like teak and sandal, cotton fabrics and valuable and semi–valuable stones.

Early State Formations and Agriculture

The procedure of state formation offers insights into development, interaction and integration of eco-zones in early peninsular India. Three major phases in the procedure of state formation have been recognized in the Tamil

region. In the proto-historic era urbanized micro-eco-zones ruled through clan-based chieftainships. These micro-zones were basically habitats of proto-historic societies. In the Tamil anthologies one discovers, references to macro eco-zones, which were produced out of interaction in the middle of micro eco-zones. In the early historic era, these macro-eco-zones were integrated under the secondary state of Satavahanas. The Pallava era ushered a marked change in the organisation of agrarian manufacture. While the warring chieftains were unable to use force on peasants for manufacture in the earlier era, the *brahmanas* exhibited better management as a corporate body. The *brahmana* landowners efficiently supervised the labour, both for agriculture and arts and craft. These *brahmanas* in the Pallava-Chola era, wielded power and status and as recipients of land endowments enjoyed many privileges in excess of 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 whispered that the core metropolitan region initiated the procedure of conquest and manage of diverse regions with differential access to the possessions: an agricultural rich tract, mineral rich stretches and deal routes etc. Forest dwelling societies were either forcibly subdued or placated and tamed, depending upon possibilities of the relevant strategy. The state was faced with the require of agrarian surplus as well as forest produce. Agrarian surplus required forest clearance and colonization of new regions. On the other hand, the forests were also to be protected for their material value. Therefore, equilibrium had to be created flanked by 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 capability, which might have caught the attention of the metropolitan state of the Mauryas. The tribe of Andhras is mentioned beside with several other tribes in the Ashokan Rock Edit XIII. The shift of

iron epicenters outside the Gangetic belt and search for newer resource regions brought Ashoka to the peninsula. Consequently iron ores in the Deccan were tapped. The attendance of Ashokan inscriptions in the gold mining regions of Karnataka further substantiates this point.

Kautilya's *Arthasatra*, a text of political economy highlights the profitable nature of the southern deal route as it passed through gold mining regions and abounded in valuable items like rubies, pearl and diamonds. The Mauryans recognized their provincial capital at Suvarnagiri (meaning gold mountains) in Karnataka. They issued their rock edicts in this region. Fertile alluvial plains of the Krishna-Godavari delta and the mineral rich Eastern Ghats facilitated the pre-state growths in Andhra. Likewise, the Southern Deccan had dispersed fertile pockets. Though, not all the pockets of Deccan attest proof pertaining to Mauryan get in touch with. Though the iron was present in Deccan, it could not be used effectively for the agrarian expansion owing to sure ecological factors.

Early Medieval Agrarian Growths

In the early medieval era, agrarian growths 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 civilization was getting organized. *Brahmadeyas* and the temples appeared as instruments of agrarian expansion. Creation of such organizations was accompanied with clearance of forests, construction of irrigation devices and management of cultivating labour in the regions, hitherto strange for growth of agriculture. Agricultural infrastructure was increasingly being created. Whether the sponsorship of such infrastructure rested with the state, intermediary groups or the regional autonomous bodies cannot be consistently true for the whole of peninsula. What is sure is that agrarian expansion was a continuous procedure and the emergence of newer organizations facilitated the integration of the existing agrarian regions. Pallavas and Pandyas did adopt and vary North Indian elements to the specific

agrarian situation of their regions. As implementers of stone sluice technology, they made major contribution to artificial irrigation.

Nadus and the Newer Instruments of Agrarian Integration

Nadus, which evolved out of peasant settlements, can be measured as vital agrarian units in early medieval Tamil land. Seen as peasant micro-regions, the antiquity of some of these can be dated back to the era of earliest Tamil anthologies. These agrarian entities owed their dynamism to interactions with the newer evolving organizations of agrarian expansion. In the early medieval centuries, their numbers rose in all the Tamil macro-regions. Dissimilar ecological zones differed in their access to utilization of water possessions. While the riverine regions like Kaveri delta necessitated the adoption of flood manage mechanisms viz. embankments and canals, in the drier and upland regions, tank and reservoirs were constructed. The procedure of expansion was at times accompanied with disagreement flanked by dissimilar survival 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 procedure of such an expansion can be seen in Pallava region of Palar- Cheyyar valley and Pandya region of Vaigai-Tamraparni valley. Through eleventh century, mainly of *Nadus* had appeared, the highest number being in the Kaveri valley.

Although the term *Nadu* literally means cultivable land, it was usually applied to settlements irrespective of the degree and stage of agrarian development. *Periyanadu*, a supra-regional organisation of agriculturists appeared in eleventh century A.D. in the drier regions North of Kaveri and sustained to operate till the fourteenth century A.D. This organisation was more active in peripheral regions. Another division created through re-aligning *nadus* into superior units primarily for revenue purposes was *valanadu. Valanadus* were delineated on the foundation of natural boundary markers like watercourses.

Brahmadeyas or land endowments to *brahmanas* were institutionalized in Andhra and Deccan at an early date i.e., fourth century A.D. while the

Tamil region witnessed such growths only through the seventh century A.D. These endowments were situated in virgin land or already cultivated land. In the Pallava-Pandya regions, the reservoirs with stone sluices were urbanized through the ruling class and maintained through regional bodies recognized 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*, rustic-cum- agricultural regions. Studies on the temple sharing have revealed that throughout the Chola era there lived a connection flanked by agrarian expansion and temple ecology. Beside with the *brahmadeyas,* temples appeared as significant instrument for agrarian integration of several pockets like *nadus* and *kottams.*

Reclamation, Irrigation and Crop-manufacture

Agrarian expansion in the early medieval era had three significant dimensions:

- Horizontal expansion of farming 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 augment in crop manufacture.

Burton Stein recognized three episodes of relatively stable agrarian integration in South India from the ninth to the nineteenth century. He writes, "In only one important respect was there an significant change – the connection of cleared, cultivated land to forest. The reduction of forest and the expansion of regularly cultivated land was a continuous procedure… As in any developing tropical, agrarian organization, the clearing of forest was one of the average methods for expansion; this type of change in environment may so be measured a regularized procedure in which the tempo of expansion is a factor of vital importance". Though, no uniform pattern is discernible in the whole of peninsula, although it is possible to speak of common growths. Not all the regions could be deforested for developing agrarian settlements. In the

Eastern Ghats, the settlements in the thick forests with shrub-savannah and thorny thickets remained non-agricultural in nature.

Though, those on the foothills had natural catchments where tanks could be constructed with lesser efforts and agricultural behaviors could be accepted 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 organizations 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 farming of rice. Skandasisya of the late Pallava era ordered the clearance of forests through 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 procedure of extension of cultivable tracts. The land endowment records mention many boundary markers like water bodies, plants and trees and forests, village's societies besides referring to land size productive capability and the nature of soil.

Irrigation received special attention in the early medieval era. Development of sluice-weir in channels to draw water from tanks and rivers did not develop before the Pallava era. 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 customized techniques of *picottah* was a dominant practice. Another significant development was the creation of channels from the rivers to feed the tanks. Inscriptions from several talukas of Karnataka attest the attendance of such channels. While the technological changes were being introduced in the drainage organization, the management of tanks for the purposes of de-silting, repair of broken sluices, or raising the capability of storage necessitated the organisation of irrigation.

Growths in the drainage organization were directly related to wet cultivable produce. Other crops, manufacture of which increased in the early medieval era incorporated extension of farming to wildly grown products,

garden products, vine crops and many new crops. The surplus produce of wet rice could be used for short or extensive aloofness swap or temple related rituals and services. Because of demographic pressure, diversities of millet like finger millet (*ragi*) and fox tail millet (*kanuga*) and sure inferior granules like *jowar* came to be cultivated on a big level. 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 farming of *ragi*. If the Tamil anthologies are whispered, the manufacture of sugarcane can be dated to early Christian centuries. A logical development was manufacture of jaggery.

The manufacture of jaggery was a extensive drawn procedure and it assumed commercial proposition through the tenth AD. The increased farming of betel leaves (*tambula*) and areca nuts (*guvaka /puga*) in the eleventh century AD. has been connected to their ritual consumption in the temples. Regional studies on the western coast of Konkan have amply demonstrated the manufacture of areca nuts on a commercial level from the middle of the ninth century A.D. The western coast was also popular for manufacture and deal of spices in common and black pepper in scrupulous. Coconuts, widely recognized for their ritual status were introduced in the peninsula in the early Christian centuries. Orange was almost certainly a native of Kashmir and was diffused in the peninsular India approximately tenth century AD. It was being cultivated in Karnataka before tenth century AD from where it was diffused to the Arab world.

Geo-polity and Agrarian Expansion

Geo-political context of significant dynasties in the early medieval centuries gives useful insight in to agrarian specificities in the peninsular India. The core region of the Hoysala and the Kakatiya dynasty, situated in the contemporary 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 in relation to the 1/5th of sown acres in Hoysala Kingdom and 1/8th 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 situated in the rich riverine plains providing extended zones of farming and were therefore more densely populated. Tirunnelvely district under Pandyas exported granules, cotton, cotton clothes and bullocks to Malabar Coast. Vaigai basin in the fourteenth century imported money, coconuts and fish. Cholas used grain surplus to set up swap dealings extending up to Malaysia.

Eco-zones: Phased Opening of Agrarian Frontiers

Studies on resolution histories while taking cognizance of agrarian specificities in conditions of environmental factors, crop and irrigation factors also highlight phased opening of agrarian frontiers at a regional or even a micro regional stage. The procedure of the creation of an agrarian region in early medieval Andhra brings out several facets of agrarian expansion. The proliferation of rural settlements in Andhra shows a phased agrarian expansion. Though the agricultural behaviors sustained in several pockets since early time, the qualitative and quantitative expansion did not take lay before early medieval era. Coastal Andhra shaped 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 through the 'high revenue yielding region' 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 big tanks and reclamation of land in the districts of Khammam, Mahbubnagar, Nalgonda and Warangal. Though the procedure of reclamation also sustained 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 level before the Vijayanagara era. Manufacture of arid crops in Rayalaseema is attested through the epigraphic references to *nela, chenu, polam* and *varipolamu*. The hero stones establish in Cudappah, Chitoor and Anantpur districts belonged to the heroes who sacrificed their lives in cattle raids. Though, in the medieval era we have instances of women sacrificing their lives in their effort to secure

breaches in the tank bunds. Anantasagaram tank in Anantpur district reveals one such story. Within Andhra, the coastal region has been characterized as a wet ecological zone, Telengana a mixed ecological zone and Rayalaseema as the region of arid farming. Though, exceptions lived in all these ecological zones. In the coastal region, Eastern lowland border stood in contrast to the elevated Western location. In Telengana, the central and the eastern part witnessed steady rise in tank construction. Red soil could become productive only with the wet farming. In the Rayalaseema region, Cuddapah despite being the hilliest region opened early to agriculture because of its basins at the confluence of Krishna and Tungabhadra rivers. Anantpur and Kurnool urbanized last. The epics of *Palnativirula Katha* and *Katamaraju Katha* point out to limitations of fragile ecology and the disagreement flanked by dissimilar survival methods in excess of resource-use. Palnadu country, recognized within the contemporary 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 disagreement flanked by 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 recognized flanked by 10th and mid 14th century AD. Though, in the mid 16th century even the driest portion of Salem was also opened to agriculture. In a revise of Tirunnelvely, specifically from agricultural point of view, three ecological zones viz., the wet, the mixed and the arid, have been recognized. The wet zones were recognized through 1000 A.D. The arid zone depended on the mercy of rains, was favourable only to farming of millet. This zone, rich in black and sandy soil was colonised in the fourteenth century A.D with migrants from other spaces including Andhra hinterland. The mixed zone abounding in elevation and red soil had moderate rainfall. Here, the slopes facilitated the construction of reservoir kind tanks. Such terrains also facilitated the construction of big tanks elsewhere. Ramappa lake in Mulug taluk of Warangal district was likewise bounded through hills on three sides and its bund on one face had a height of 56 feet and a length of 2000 feet.

In the Narsampet taluk of the similar district, Pakala lake had a dam made up of laterite pebble and earth, in relation to the one and a half kms. extensive from which 40 channels were created. The procedure of proliferation of rural settlements and emergence of agrarian regions, which began on a considerable level under the dynasties of Hoysalas, the Kakatiyas, and Pandya-Cholas, was really accelerated in the 16th century Vijayanagra era. New agricultural frontiers were opened in the drier upland stretches and market oriented manufacture of cash crops like cotton and indigo began. Resolution studies, which classify phased growths in several 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 through pastoralists till its re-colonisation through Adil Patsah of Bidar.

REVIEW QUESTIONS

- Examine the significance of Neolithic Revolution.
- Discuss the origin of rice cultivation in India.
- Discuss the relationship between the behaviour of rivers in the Indus region and the growth of agriculture.
- Examine the pattern of agriculture in the Indus Civilization.
- Why did plough become a symbol of power in later Vedic period? Discuss
- Medieval India was marked by a relative surge in irrigation devices. Explain.
- Irrigated agriculture followed the pastoral economy in the megalithic age. Comment.
- What are the three dimensions of agrarian expansion in the peninsula in the early medieval period? Describe.

CHAPTER 4

Appropriation of Environment: Other Forms

STRUCTURE

- Learning objectives
- Energy resources
- Water resources
- Forest resources
- Metal & mineral resources
- Review questions

LEARNING OBJECTIVES

After reading this chapter, you should be able to:

- Explain the forms of energy.
- Understand the energy consumption.
- Understand the conservation
- Understand the issue of water rights in the historical perspective along with the theoretical propositions connected with water rights.
- Understanding the forest and forest coverage.
- Describe the metal resources and explain the historical evolution of metals

ENERGY RESOURCES

Shapes of Energy

Energy is usually understood to carry the meaning of the source of strength that is necessary for performing several types of behaviors. Mainly of the shapes of energy are shapeless and not easy to be subjected to physical verification. They can be verified mostly in conditions of the job performed with their support. The word energy is derived from the Greek *energeia* which is made up of *en*, "in" and *ergon* meaning "job". Evidently its meaning centres

approximately the job done through by energy. The thought of energy in the sense goes back to Galileo in the seventeenth century. He recognized that in lifting weight the force that was applied was in information a form of energy. The thought was further urbanized through Newton who suggested that the quantum of force applied on an substance was associated with the acceleration gained through that substance.

The shapes of energy broadly range flanked by inanimate natural shapes and animate shapes of energy; and when we step on the industrial civilizations electrical and nuclear shapes add up. Humans and animals perform job with the help of their physical energy. This is the simplest form of animate energy. Likewise natural or inanimate shapes of energy are situated in mainly of the physical matters. They are available at the primary stage in the form of solar energy and wind and water energy and at the secondary stage in the form of thermal, mechanical and chemical energy. It is, though, hard to enumerate all the several types of energy. The sources of energy are visible, but the energy itself is transitory, recognizable through the procedure of action generated through it. So in our effort to identify the shapes of energy we are greatly helped if we focus our attention on the sources of energy. The shapes are closely linked with the sources; it is easier to recognize 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 shapes of energy: first being animate sources of energy and the second, inanimate sources of energy.

For a extremely extensive span of time in history, barring the energy emitted through sun, humans have depended upon the animate sources of energy. In the initial stages of development human physical power was measured as the primary source of energy. For all those extensive centuries of human subsistence when agriculture had not urbanized and hunting-gathering behaviors were the principal mode of livelihood the physical prowess of the humans was the principal source of energy. This prowess was augmented with the help of stone apparatus and implements that were manufactured under an organized method. The effort obviously was to sharpen the human physical energy and cautiously segregate mainly of the job done for a differential use of

energy to be applied to them. The detailed classification of stone apparatus into core and flake apparatus and into microlithic apparatus of several types bears ample testimony to this effort. Mention may be made here of a mechanical device described spring which accumulates energy and releases it suddenly when required. It's first recognized 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. Though, the effectiveness of the easy bow was limited through the strength of the arms of humans who would use the device.

After that to be utilised through 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. Animals as the source of energy were utilised in numerous spheres of life. They were also an significant source of food for the humans. Animal power was harnessed for use as draught power to be utilised in agriculture. The utility of animal power had become so apparent to agriculturists that in peninsular India the Neolithic locations (mid-third millennium BC) from their inception exhibited a high imperative of big number of livestock maintaining. Animals provided the energy for the transportation purposes right up to the beginning of the mechanized manners of haulage. One of the earliest references of this type of energy harness is available in the rock paintings at Morhana Pahar close to Mirzapur in Uttar Pradesh. There two chariots have been shown drawn through two and six horses respectively. Another significant region where animals supplied energy was in the field of irrigation/water lifting devices. Likewise cow also provided cow-dung, extensively used to fire the hearth. Human as well as animal excretion has been extensively used in the meadows as fertilizer to augment the agricultural manufacture.

Early humans first made controlled use of an external inanimate energy source when they exposed the use of fire. Burning dehydrated 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 several other purposes such as housing, and the creation of

furniture, carts, agricultural apparatus, musical instruments and numerous other handicrafts. Wood has been an integral component of human housing since ancient times. Even in the mud homes 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 type of action kept on rising with the augment in the population and material development of human civilizations.

In humanity's early effort to harness inanimate, natural shapes of energy, water occupies a central location. Besides being a key life sustaining resource for mainly of the livelihood beings including humans, the irrigation potential of water for sustaining agriculture had also been exposed fairly early. The first culture in India as also elsewhere in the world was riparian in character. Here we are concerned with the use of water as an significant energy resource. Not much early proof on this matter has been garnered. We may though speculate that the flow of water in major streams and rivers would have been used for transporting the big tree trunks and logs from one lay to the other. This practice has been in use even today. A greater use of water energy though becomes possible after the development of a few mechanical devices that were energy saving through them. Perhaps the earliest use of water in this fashion was in driving waterwheels. In the hilly regions of India and in same 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 period of uncontrolled use of inanimate sources of energy began. Mainly of the natural inanimate resources were now harnessed. The pressure on them slowly increased and the stage of use began endangering the subsistence of mainly of the natural resources. All this, though, relates with the onset of contemporary age.

Energy Consumption: Historical Patterns

It can be conveniently argued that the social development of humans has been closely tracked through growths in same manner in the stages and patterns of energy consumption. In the early stages of human civilization the

nature of energy consumption was more or less equal in conditions of its horizontal and vertical expanse. The stages of energy consumption had remained confined to bare necessities and the possibilities of surplus retention were extremely limited. Mainly of the demands for energy through these civilizations were available in the form of food procurable in the vicinity. It was with the growth of agriculture on the one hand and the domestication of animals on the other hand that the require for newer sources of energy arose and the consumption of energy multiplied. The mainly significant change was in the vital source of energy: manpower was slowly replaced, first through 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 through in relation to the 300 BC.

The after that major development was the use of the water and wind energy. One of the mainly significant uses of water energy was in agriculture for irrigation purposes. The sharing of water to cultivated meadows through channels has been an old practice. An early proof pertaining to irrigation of this kind relates to Mesopotamia and dates back to in relation to the eighth century BC. This irrigation was helped through the proximity of the Tigris and the Euphrates, which assured a constant supply of water. As described through Seton Lloyd, "Approximately 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 farming. Proof of this is the profuse network of ancient irrigation canals, now abandoned, whose spoil-banks, like parallel ranges of little hills, run distant out into the plain beyond the scanty farmlands of the present day".

The evidence from Harappan resolution suggests that little bunds were erected crossways the rivers to use the flow energy of water for spreading fresh alluvial soil beside the banks. This soil was then used as agricultural field. The knowledge of the Harappans in relation to the water energy is further supported through the detection of the well-known dock-yard at Lothal. It points to the information that knowledge relating to the tidal currents was tactfully used in creating the dock so that ships could approach in with

flow-tides and could go out into the sea with ebb-tides. A extremely early use of water energy was in driving wheels. The proof relates to in relation to the 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 kind of mill was used for grinding cereals or oil-producing plants. In information this was the stage when natural energy and mechanical contrivances were combined. This gave a extra ordinary boost to the use of energy as it enhanced its driving power considerably.

The early waterwheels, first used to drive mills for grinding grain, were subsequently adopted to drive sawmills and pumps, to give the bellow action for furnaces and forces, to drive tilt hammers or trip-hammers for forging iron, and to give direct mechanical power for industrial mills. Until the development of steam power throughout the industrial revolution waterwheels were the primary means of mechanical power manufacture, rivaled only occasionally through wind mills. Therefore, several industrial cities sprang up at sites where water flow was perennial. In an old reference to a watermill dating back to in relation to the 85 BC, appearing in a poem through an early Greek writer, the liberation from toil of the young women who operated the querns (primitive hand-mills) for grinding corn was celebrated.

Just as to Greek geographer Strabo, King Mitheradates VI of Pontus in Asia used a hydraulic machine, presumably a watermill, through in relation to the 65 BC. Early vertical-shaft water mills that drove querns were recognized in China through first century AD, and were used throughout Europe through the end of the third century. A horizontal-shaft water mill was first described through the Roman architect and engineer Vitruvius in relation to the 27 BC. The Roman mills were adopted throughout much of medieval Europe and waterwheels of rising size were made approximately entirely of wood. In addition to flowing stream water, ocean tides were also used though rarely to drive waterwheels. Like watermills, windmills were in the middle of the original prime movers that replaced animal muscle as a source of energy. They were used for centuries in several parts of the world, converting the energy of the wind into mechanical energy for grinding grain, pumping water, and draining lowland regions. The first recognized wind device was described

through Hero of Alexendria. The earliest recognized references to wind driven grain mills, establish 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 in excess of land, often for considerable aloofness, but the power-loss necessity have been much.

As with waterwheel, it is hard to estimate the power output of windmills. A big Dutch windmill of the eighteenth century, with a 100 feet (approx. 30 metres) sail-span, almost certainly generated in relation to the 10 horse power (h.p.) in a 20 miles per hour wind speed. Smaller mills, with a 24 ft (almost 7 m.) span, almost certainly acquiesced in relation to the 5 h.p. Theoretical thoughts illustrate that the windmill in its traditional form could not, at best, yield more than 30 h.p. It was not, so, a powerful prime mover through contemporary standards, and a substantial proportion of such power as it did develop necessity have been dissipated in the clumsy transmission organization, even after iron gearing had been introduced. The foundations for the use of steam power are often traced to the experimental job of the French physicist Denis Papin. In 1679 Papin invented a kind 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 through a Scottish instrument maker James Watt in 1765 that urbanized a steam engine. Although distant harder 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 significant development with regard to energy utilization had been the detection of a device through 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 spaces

from the source of its generation. Likewise another major energy resource has been the nuclear energy which has a great potential.

Conservation

The concept of energy conservation is related with the theory that the energy remnants constant and it only changes its form. The conservation of energy is not a account of any procedure going on in nature, but rather it is a statement that the quantity described energy remnants 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 in accessible organization as well. Energy exists in several shapes and is convertible to one-another within the constraints of conservation law. These dissimilar shapes of energy contain 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 dissimilar shapes, that makes it so attractive and useful. Though, one necessity keep in mind that all the shapes of energy are still not in manage of the humans. Mainly of the energy we consume has led to augment in the other unwarranted shapes of energy. The mainly visible instance can be the uncontrolled consumption of combustion energy which has led to augment in the chemical energy causing Ozone depletion. So it is necessary to realize the spirit of the law of conservation of energy and either manage in excess of-consumption of energy or develop other non-conventional sources of energy.

Mainly of the energy resources consumed through humanity are exhaustible and non-renewable so it is necessary to be prudent in one's consumption of finite sources of energy. At the similar time, we necessity realize that there are many renewable sources of energy and it is suggested to develop the technology to harness the potential that is going waste.

WATER RESOURCES

Water as a Resource

Water is one of the significant substances necessary for life. Water covers in relation to the 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 shapes of terrestrial and aquatic life. There are subterranean reserves of water at extremely deep stages and also at shallow depths trapped in the soils. This trapped water is extremely useful for agricultural manufacture and even for direct human use. The use of water as a resource has focused on this little amount.

Properties & Sharing

Water in its' fluid form does not exist on any other planet in our solar organization and is therefore an exclusive privilege available to the inhabitants of planet earth. Only at a sure aloofness from the sun do we discover the right temperatures that permit water to exist in liquid form. The other unique property linked with water is that it becomes mainly thick 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, jeopardizing fish and other aquatic life. Water has surface tension and great capillarity, that is, the skill 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 mainly significant sources of energy. Inexpensive, nonpolluting, hydroelectric power is a boon to all. Water dissolves salts of several types; 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 require via water based salt solutions.

These properties also have some disadvantages. The similar water also dissolves pollutants, acidifying our lakes and waterways and poisoning livelihood organisms. It also spreads disease in flora and fauna. Though water

is measured a renewable resource it is finite and governed through a natural water cycle. The stable water supply of earth is used again and again in this cycle. In relation to the 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 shapes 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 procedure of evaporation, condensation and rains is recognized as water cycle. This cycle keeps replenishing the water necessities of the world. The global sharing of water shows that only 35% of the total quantity is fresh water, which is available in several shapes.

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 catchments region of 252.8 million hectare (m.ha.). Tanks and ponds have approximately 2.9 m. ha. region, reservoirs have approximately 2.1 m. ha. region, where as smaller rivers and canals inhabit 7 m. ha. region. Mainly of the region under tanks and ponds are situated in southern states of Andhara Pradesh, Karnataka, Tamil Nadu, followed through West Bengal, Rajasthan and Uttar Pradesh accounting for approximately 62% of the total. In the case of reservoirs, Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Uttar Pradesh control. Orissa ranks first as distant as brackish water is concerned and followed through Gujarat, Kerala and West Bengal. The annual precipitation including snowfall which is the main source of the water in country is estimated to be approximately 4000 cubic km. The resource potential of rainfall for the country is estimated to be approximately 1869 cubic km. Clearly, the water resources are therefore unequally distributed in excess of 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 measured as scarcity situation.

The ground water situation in dissimilar parts of the country is as varied as the surface water situation. In the high relief regions of the northern and north-eastern regions occupied through the Himalayan ranges, the several hill ranges of Rajasthan, the central and southern Indian regions, the attendance of extremely steep slope circumstances and geologic structures offer very high run-off and therefore extremely little scope for rain water to discover favourable circumstances of storage and circulation as ground water. The big alluvial tract extending in excess of 2000 km, recognized as Sindhu-Ganga-Brahmaputra plains is the mainly potential region as distant as ground water resources are concerned. Approximately the whole central and southern India is occupied through a diversity 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 circumstances have acquiesced 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 through vast and extensive alluvial sediments and are extremely productive in conditions of water availability but in the vicinity of coasts suffer from salinity.

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 civilization since ancient past. All the early civilizations were distinctively and predominantly riparian. Prime examples of ancient river valley civilization of the world are Egyptian civilization in the Nile valley, the Mesopotamian civilization in the valleys of the rivers Tigris and Euphrates, the Harrapan civilization in the Indus valley and the Chinese civilization in the Hwang- Ho valley. Harness of water from natural resources and its careful use in agriculture and other behaviors is a hallmark of these civilizations.

Archaeological proof shows that sure engineering events were also adopted to enhance as well as sustain water resources.

As we step on a era 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 mainly beneficial manner. Reservoirs are made, embankments are raised, wells are dug up, channels created for transporting water to desired destinations and devices invented for utilizing the several 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 through their ingenuity even today. The proof is rich and thick and any efforts at listing all of them are likely to use a vast legroom. We shall effort a random recall which is also likely to be a rewarding exercise.

We can begin through recalling some of the feature characteristics, related with the use of water as a resource, of the first culture on the Indian sub-continent. The environmental settings were arid or semi-arid. The importance of water as a resource was clearly understood. The environment locations 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 exhumed in the river basin to take water to agricultural meadows. A canal of this kind has been traced close to Shortughai drawing water from Kokcha river. The wells were made for use through individual households that seldom changed their site – the earliest proof of the use of ground water. Drainage was cautiously planned so that the waste did not pollute the fresh sources of water. Cities like Dholavira, bounded through brackish water, paid great attention to water storage. “In its heyday, the whole municipality might have looked like a lake municipality or a *jala durga* (waterfort). The region reserved for the tanks was immense, almost 750 m. in length and the southern and northern margins, while the width varied from 70 to 80 m. In the west, the tank region was in relation to the 590 m. In the south-eastern region, for instance, the reservoir sheltered in relation to the 5 ha (hectare), the main within the walled region. The walls acted as effective bunds. Both faces of the wall were plastered with fairly water-repelling sticky clay. Special and

vulnerable regions, mostly on the exterior face, were vencesed with hammer-dressed stones.

Keeping in mind the common slope of the municipality, many bunds was constructed crossways the width of the tanks to reduce the pressure of the stored water body on the municipality walls. The bunds also served as causeways for easier movement. In times of scanty rainfall, they enabled the water to get stored in selected tanks instead of being spread out in excess of a big region and reduced quickly through evaporation and seepage. In the region designated as the citadel, an motivating networks of drains, both little and big, was exposed. Mainly of the drains intersect each other and ultimately link up with an arterial drain. The whole drainage organization could have been set up to assiduously conserve every drop of rainwater that fell in the municipality. The water necessity has been a treasured commodity in an region lacking in perennial source of surface water and where the ground-water, mainly brackish and saline, tends to arid up throughout droughts".

The importance of water for agricultural civilizations throughout the Vedic era necessity has 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 similar device are *Sushira* and *Soormi*. Wells – *avat* – were dug up. Lifting devices to draw water from the wells were also in use, described *ansatrakosh* and *ashmchakra*. These were almost certainly composed of a leather bucket drawn in excess of a pulley for lifting water from the wells. Mauryans, as the founder of one of the earliest empires, gave special importance to water resources. On the power of Kautilya we know that the structure of reservoirs through damming streams was an significant public job the king was encouraged to construct. Likewise Ashoka refers in his edicts to the construction of wells and watering-spaces beside the major routes. The epigraphic proof testifies to the construction of a big reservoir of water through damming a stream in the Junagarh district of Gujarat through Pushyagupta, the governor of the region throughout 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 through Rudradaman. The dam appears to have been maintained till the fifth century AD when the last recognized repairs were accepted out through Parndatt throughout the reign of Skandagupta, in AD 457-8.

Since medieval India was also a mainly agricultural civilization, the resourceuse practice with regard to water was basically geared at providing irrigation to the meadows. Besides by mainly of the prevalent methods, a few new techniques were introduced throughout this era. The prominent in the middle of them were *arghatta* and *arhat* (Persian wheel), which improved irrigation significantly. In the 14th century a extremely elaborate network of canals was constructed through 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 regions. Due to greater and more secure availability of water, manufacture of cash crops had increased. The similar concern for the use of water resources was shown through the Mughals. They also promoted irrigation facilities through providing loans to farmers to install irrigational devices. There was a common 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 organization of tanks, little and big both and the mechanism of their regular upkeep from a extremely early time is too well recognized. The streams and rivers were also channellised through raising empanelment's and dams. The well-known *anaikattu* (anicut) on Kaveri river was built through Chola rulers for the irrigation of the lands in Tanjore. Big dams were also built in this region for creating big reservoirs of water. Ka Katiya rulers are recognized to have built three big dams in Warangal. Another dam situated at Kamthana, close to Bidar built through the Kakatiyas, supplied water for irrigating the neighbouring region. The epigraphic proof and archaeological remnants support this picture. This picture changed drastically after the colonial power recognized manages in excess of India. The apathy and neglect shown through the new dispensation towards these age old resource-use practices resulted in the ruin of mainly of these devices. Francis Buchanan noted this pitiable state throughout his travel beside 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 through Centre for Science and Environment and their compilation of the results of survey published under the title *Dying Wisdom*. We strongly suggest to you to use this book to get superior information on the subject. The optimal management of available water resources today has become a major issue world in excess of. The spatial and temporal variability of rainfall beside with high evaporation and runoff is posing a major challenge to the scientific society. Added to these is the rising 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.

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 civilization but the demand has multiplied. Water has become at least as significant a resource as oil. Water shortage and deteriorating water excellence are the two major concerns today. It is therefore apparent that there is an urgent requires to initiate events 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 require to be examined in some detail. Water conservation has a extensive history going back to earliest times. The require of conservation at that time was perhaps to save water for the lean era of the year. It was conservation directed at quantity as excellence conservation did not appear to be their concern. The proof for water conservation is available from ancient literature, epigraphy, archaeological remnants and local oral traditions. Conservation was a special characteristic in habitats that were situated a little absent 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 custom. Approximately every dwelling element of Harrapan civilization had a well. Mohenjodaro records in excess of 700 wells. Unlike other running sources like rivers or streams wells provided an option to fetch only the required amount of water – an early proof on judicious use of water. Another source of water, that is the running water, but particularly the flood water was extremely nicely utilised through past cultures. We have the proof from Srinagaverupura situated close to Allahabad on the banks of river Ganga.

Throughout the monsoons, the river swells up through in relation to the 7-8 meters and spills into the nearby artificial canals. This canal was dug through settlers of the region to carry superfluous floodwater. This diversified water was stored in tanks, to be used throughout lean eras 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. Therefore after that tanks received cleaner water. The mechanisms of rainwater conservation though differed just as to the physiographic characteristics 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 recognized as *Kund/ Kundi*. Individually rooftops were used as catchment region which composed rainwater and stored it in an underground tank. This water was even potable. In other languages *Kund/Kundi* were artificial wells conserving rain which would have otherwise run-off. The mechanism was also used in open field for common public where alike *Kund/Kundi* were built and the neighbouring region used as the catchment.

A extremely indigenous method to secure drinking water was practiced in the Runn of Kutch through 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 recognized as *Virdu* method of water conservation. In the North-East Himalayan region people urbanized methods of carrying natural spring water for drinking purposes. As the region is mountainous, the rainwater runs off extremely fast. Though, 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 extremely motivating method of water harvesting is practiced through Jarwas in Andaman. Although Andaman Islands have an annual rainfall of 3000 mm it runs-off rapidly due to ragged physiography of the lay. The Jarwas use full length split bamboos. An whole length of bamboo is cut longitudinally and placed beside a gentle slope with the lower end leading into a shallow pit. These serve as conduits for rainwater which is painstakingly composed in pits described Jack wells. These split bamboos are also placed under trees to collect the fall of rains through the leaves. A series of increasingly better Jack wells is built, linked through split bamboos so that overflows from one lead to the other, the better one. This stored water is basically used for domestic purposes.

We have already read in relation to the Sudarshan lake close to Junagarh which was constructed to store water for domestic and irrigational purposes. Alike proof for tank and canal construction from ancient past from dissimilar regions is also available Hanthigumpha inscription of 2nd century BC. describes that a canal was dug in Tosali division close to capital municipality of Kalinga. Just as to the Kuntagiri plates, the Kadamba king Ravivarmann ordered construction of a tank bund for irrigational purposes. Mainly of these were urbanized to channels water for optimal use which otherwise would have gone to waste. Such an awareness of water conservation appeared due to unequal seasonal sharing of rains. The plateau region- Deccan is full of artificial tanks which stored rainwater for irrigation. These are recognized through several names like *arakes, volakere, derikere, katte, kunte, kola,* etc. depending upon the variation in structure and nature of use.

Alike structures are described *zing* in Ladakh and *ahar* in south Bihar where water from seasonal streams or rainwater is stored to be used in ensuing era for domestic and agricultural purposes. *Ahars* are rectangular catchments getting water flowing through hilly rivers. On same rows 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

aloofness. Through creating cuts in the canals floodwater was released to meadows.

A extremely useful method of water conservation for irrigation was urbanized through Paliwal Brahmins in the arid region of Rajasthan. They created rain fed water storage structures, which allowed runoff to stand in excess of and moisten the soil bed of the storage structure itself. This piece of land was later used for rising crops. These structures were recognized as *khareen*. Another unique method of rainwater harvesting is recognized as *haveli* as practiced in Madhya Pradesh. The region has heavy black clay which can hold a big 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 through an opening into embankment. This release makes soil soft and allows the sowing of wheat and gram to rarely require second helping. The account make it amply clear that several methods of water conservation were practiced traditionally depending upon the local requires. These methods utilised every type of water supply – rains, floods, ground water, etc.

Water Rights

The details of resource-use practice given make it clear that water has been measured a useful essential resource. So rights to it have also been zealously safeguarded. In early times, though, population was limited and it was often possible for individuals or societies to settle differences in several cases through basically moving on and exploiting a new source. The level of water available in mainly situations and consumptive uses, even for irrigation, seldom threatened others with deprivation. Customary rights/uses regulated mainly transactions.

Slowly greater rights began to be exercised and in several 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 same devices. No codified procedure though had approach into practice. It was, though, from the nineteenth century onwards that water laws for several uses began to be invoked. This trend was further strengthened with the multiple uses and rising

diversions for consumptive/commercial use which were often conflicting in practice. The problem has since then become more acute because of rising population. The rising demand in excess of the availability has been creating scarcity and resultant disputes. In excess of the world a serious and rigorous thinking on availability of earth's fresh water resources and possibilities of use 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 through new claims. More than 200 countries in the world have to share their general 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, excellence of water, and management of water are the three issues being discussed in modern world. Hence, there is a require to describe the rights in excess of water and their historical development. It was whispered for a extremely extensive time that water in a natural stream was not the subject of property but a wandering thing without an owner. Though, this understanding underwent a important change in the industrial world and the issue of water rights came into subsistence. The genesis of water rights is usually traced to the rights of navigation in rivers that often shaped the boundary flanked by two states. Rivers that shaped natural boundaries or flowed through successive domains or territories and came to be used as a general highway were supposedly open to all for communication and commerce. Though some states began to exercise greater manage in excess of them thereby denying others, or reducing their, usage of the resources. This necessitated framing of some type of laws as the dispute in excess of ownership rights of water increased. Conventions pertaining to the Danube flanked by Austria and Turkey in 1619 and the Rhine flanked by Germany and France in 1697 were in the middle of the early landmarks in the creation of contemporary International law on navigation. Inland navigation was an thing 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 industrialization. Political issues of

boundary alignment beside wayward rivers tended to be settled on the principle of the median row - a row purporting to demarcate the deep water course of a river. Though, braided rivers and those prone to make big erosive invasions of territory on either bank have sustained 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 as extensive as people livelihood absent from the river satisfied their requires from other sources. Though, with the change in nature of utilization/requires it is no more viable.
- ***The Prior Appropriation Theory*:** Just as to this theory water in the natural course is the property of the public. It is in information a appropriate version of the riparian theory which puts the earlier appropriation right holders on advantage in excess of all subsequent users.
- ***The Territorial Sovereignty Theory*:** Just as to this theory the owner has an absolute user right. This notion of private property when extrapolated for the whole domain of natural resources generates territorial sovereignty principles.
- ***The Equitable Apportionment Theory*:** Equity is a legal or a judicial notion so it gives foundation 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 requires.
- ***The Equitable Utilization Theory*:** It says distribute the resources equitably such that optimum utilization occurs for all concerned when all relevant factors are taken in to explanation. It is based on the guidelines laid down through the Helsinki rules for equitable utilization of water resources.
- ***The Society Interest Theory*:** In 1851 the English general law made a distinction flanked by *bonus vacans* and *public–juris* that is flanked by 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

through numerous societies all beside their flow. As a principle of sharing this theory allows the groups, participatory in the sharing, to be defined as societies in several ways, as civilization specific groups or domicile specific groups. Otherwise it is based on the equitable utilization theory.

- ***The Public Trust Theory*:** It emphasizes that the principles of distributive justice require not be based only on the notion of private property, rather one should consider natural resources a general 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 utilize the water in such a method that it does not violate the natural rights of any individual or group and safeguards the interests of the public and of ecology.

FOREST RESOURCES

Understanding the Forest

Evidently there is a complexity related with the historical understanding of the forest as a concept. In the similar time span forests were understood differently through people belonging to dissimilar cultures. It is extremely hard to give universally applicable set of features of forest. The term *jungle* used to denote forest in modern India is problematic. Michal R. Dove has argued that, "in modern 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 variation in meaning flanked by the two conditions: 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 'arid 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''. Forest has been attributed a rawness where rules of civil civilization do not apply.

The term *jungle-raj* appears to refer to this law-lessness. This attribute of the forest perhaps originated in the context of relatively stable manufacture of food in the early-agricultural civilizations. The agricultural civilizations were glorified and non-agricultural social formations divided. The features of the forest are best understood in conditions of man forest connection in history. Recent past has shown rising incongruity in the man-forest connection. We shall have to see if in a more remote past the situation was any dissimilar. Though, in order to provide a easy coherent picture, intricate and micro-local variations shall be given relatively less attention. We would perhaps benefit if we decide a few major indicators guiding the connection flanked by man and forest. The foremost indicator is the user-resource arrangement put in lay through human's vis-à-vis forest resources. The after that important pointer is the stage of technology available for operational sing this user-resource arrangement. The final pointer is the availability of alternative resources, say agricultural resources as alternative to forest resources.

Forest Coverage

Intricate physiographic, climatic and pedagogical circumstances have given rise to as several 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 sharing of forest is extremely uneven ranging approximately from nothing in some regions (Delhi 1.5%, Rajasthan 2.5%, Punjab 3%) to almost one-third in other regions (Himachal Pradesh 33%, Madhya Pradesh 31%, Kerala 28%). Exception-ally high shares are exhibited through Tripura (63%) and the Andaman-Nicobar Islands. This sharing 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 occupancy.

The climate, land, and species singly or in combinations, describe the forest kinds. There are though some species such as bamboo, cane, reeds, neem, pipal, banyan, tamarind, palm etc., which grow all in excess of the country. Grasslands, on a sizeable level, no longer exist in India. Much of the surface region (in relation to the 59%) is either under farming or under forest cover. The pastures with scrubs and grasses are establish in patches usually in the arid to sub-humid regions of the country. Like forests, grasslands also have a difference 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 establish patches of coarse grasses, much more sensitive to in excess of-grazing. Sandier and humid soils are sheltered with poor excellence grasses and scrubs. Sub-tropical Himalaya, above 1400 m has considerable stretches of mostly induced grasslands from western Himalaya to the Burma border.

Forest in History

The earliest references of human resolution in India can be traced back to the civilization of 2-million years old (almost) stone choppers. Two technological traditions are recognized from this stage: the Sohanian and Acheulian. Sohanian civilization was confined to Siwaliks and Acheulian spread from Siwalik Hills in the north to close to Madras in the south. Acheulian locations 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 regions devoid of early human resolution were tropical forests. Acheulian tool assemblage comprises chopping apparatus, polyhedrons, discoid's, hand-axes, cleavers, scrappers, denticulate, notches, flakes and blades. Though our knowledge of the exact functions of mainly of these apparatus at this stage is extremely imperfect, it is fair to assume that they served a diversity of functions like hunting, butchering, digging of roots and tubers, processing of plants and creation of wooden apparatus and weapons. In this arrangement human dependence on forest resources is clearly

visible. Moreover this dependence lasted for a considerably extensive time. The subsequent eras of cultural development do not match with this early stage in conditions of the time span occupied through them. The man forest connection based on a heavy sustenance of man on forest resources was the hallmark of this early stage.

The after that significant stage of human resolution in India is termed as Harappan civilization. This civilization appeared 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 stage. In fairness to the efforts made through a galaxy of eminent archaeologists though, it necessity be said that material proof unearthed for Harappa culture gives important clues to man-forest connection for this stage. It is suggested that the size of Harappan urban settlements would have required wood that could only be supplied through a forested region not distant from the locations. The requirement of wood as fuel to support the firing of bricks, a conspicuous structure material of Harappa civilization, is another supporting argument for the subsistence 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-apparatus 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.

Moreover the animals depicted on Harappan stamp sticks such as elephants, tigers and rhinoceroses require forest as their habitat. Borrowing comparisons from other modern bronze are civilizations, it appears sure that forest resources necessity has been in good demand. A important point for us to note in this regard is that the borders of the Indus zone towards the east were sheltered with thick forests which the copper wielding cultures such as

the Harappans were in no location to cut and clear. Perhaps these eastern regions were heavy rainfall regions and had no important human environment. The forests on the fringes would so be available for use of forests resources.

The after that important era is the one occupied through the Vedic culture. Vedic sources portray a secure connection flanked by man and forest. Malamoud suggests: "The forest lies on the village's horizon and is, in a sure 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 establish in a distant past, in the wonderful age of the *rishis*, of those inspired seers who received the Vedic revelations".

Though, there has been a problem with the presentation of this type of harmonious connection flanked by man and forest. Indologists, working on a common conceptual stage, have shown that the dichotomy of *grama* (village) and *aranya* (forest) is omnipresent in the Vedic literature. It is discussed as a duality flanked by wilderness and culture and has the vital, fundamental opposition. Just as to this concept, forest always remnants *outside*, distanced and more or less detatched from the sphere of human praxis. Malamoud and Sprockhoff argue that there is proof that the interpretation of *vana* and *aranya* as synonyms can be establish 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 approach to the conclusion that both conditions have dissimilar connotations. *Aranya*, translated as wilderness, desert, sometimes also as forest, is connected etymologically with alien, distant; it is the dangerous, the frightening legroom, inhabited through demons, wild animals, but also through brigands, it is the legroom which one tries to avoid, it is connected 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* (meadows, inhabited legroom), 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 home construction and apparatus; here herbs and wild plants are establish, single trees may get special ritual significance as *vanaspati*. But the boundaries flanked by *vana* and *aranya* are fluid; the similar legroom, which was seen as *aranya*, as wilderness in previous times may become *vana*, utilizable forest, or land for farming. The era from 500 BC to 300 AD saw big level colonization of fertile forest lands both in the northern India and the river valley regions in the peninsular India. Greater colonization meant greater availability of surplus. Therefore tribal chiefdoms started giving method to big states; Mauryas and Kushanas in northern India, the Chalukyas and Sangam Cholas in south India. The ground for further use of forest resources was made ready in the logic of the empire structure exercise. Of course deal was also coming up in a big method 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 cities increased and the homes in cities began to use wood on a greater level. Moreover, superior timber had to be used for construction of furniture, carts, chariots, wooden bridges etc. Throughout the Mauryan era, the concept of 'hunting reserves' also came up, as hunting became a recreational action. Chanakya says that Brahmanas should be provided forests for plantations, for religious learning and for performance of penance. Several philosophical treatises were written in the forests. Upanishads and Aranyakas were the major ones. The importance of forests is further borne out through the treatment it receives in Kautilya's *Arthashastra*. Two significant forest produce noted in the text are sandal-wood and the aloe-wood, obtained from the forested regions of Kamarupa, in Assam. Though Kautilya's treatise mainly pertains to the Mauryan era the principles enunciated in it were accepted as the bed-rock of further writings on the subject. A well-recognized scholar Kamandaka who wrote *Nitisara* acknowledges the importance of *Arthashastra.* After the Mauryas, the other significant empire builders were the Guptas. But throughout the Gupta times and more particularly later Gupta times economy began to decline. There was a manifest slump in deal and cities and in the use of monetary organization.

Inscriptions belonging to the era indicate a trend towards naturalization of the economy and therefore greater pressure on land and consequently on the forest. Amidst all these growths, the forest question lost its prominence and in the later sources lesser attention was given to the forests. It is though pointed out through some scholars that throughout Harshavardhan's time agriculture and forestry had been in a wealthy condition. For this era we have an significant explanation, through Hsuan Tsang, the Chinese pilgrim who traveled in India and the border lands flanked by 629-45 AD. He records the following regions as forested regions:

- Kosambi, infested with wild elephants;
- Monghyr, a forest flanked by Magadha and this region;
- Kalinga, forest flanked by it and Kongeda having wild elephants;
- Andhra, forest flanked by it and South Kosala;
- Chole, wild jungle;
- Malaya Mountains, giving Sandalwood and Camphor.

The Delhi Sultanate stage saw a change in the situation. The total population increased, as did the number of municipalities and cities. Consequently urban population also increased. All this led to a proportionate quantitative augment in the demand for fuel wood, fruits, food, fodder etc. Demand for excellence timber for construction of boats, bridges, homes, 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 big level clearing of the forests in the Doab region such as under Balban. This was done to destroy brigandages in the region inhabited mostly through the Mewatis.

As we approach to Mughal India the information increases, in conditions of quantity as well as excellence. Mainly of this information has been plotted through Irfan Habib in his *Atlas of the Mughal Empire*. It is therefore convenient to get details in relation to the forest resources at an all-India level and at local level. The main forested regions in Mughal India were:

- The Northern Mountains or the Himalaya;
- Foot-hills/*terai* region of the Himalaya;

- The Central Indian Forests (flanked by Narmada-Son rivers towards north to the eastern coastline flanked by Narsapur and Balasore);
- The Ghat Range (beside West coast);
- The Aloe-Wood Forest (in north-east);
- Brahmaputra Forest; and
- Lac Forests (in the Ganga delta).

In the middle of the forest resources there was a big demand for timber particularly the superior diversity. Timber was required for construction of structures, furniture, bridges, boats as well as ships used in internal and external deal. There are ample references to fleet of boats/ships owned through merchants and some members of the nobility and royalty. Forests served another utilitarian purpose; the forest produce shaped an significant component of the non-agrarian manufacture throughout the Mughal era. The manufacture and use of several 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.

Table 4.1 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 apparent 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 manage. Though the demand for forest produce increased but the land- man ratio was still extremely 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 cause for loss of forest. Added to this was the factor of natural regeneration of the forests, which kept the superior forest cover under more or less ‘normal circumstances’.

Stages of Interaction

Forest-man interaction should be visualized in the context of the social relevance of the forest. The procedure of development from the easy social formations of ‘hunting-gathering’ to the intricate social formations of ‘industrial civilization’ has influenced the stage of interaction flanked by man

and forest. It is hard to describe this type of interaction because there are tremendous local variations in the physical nature of forests. Though, as suggested, effort a broad generalization to elucidate the intricacies of the social interaction with forests.

Sole Provider

The earliest stage of social formation has been termed as 'hunting gathering' where to a great extent the physical requires of the humans was catered to through the forest resources. Throughout this stage the forests were the sole provider of sustenance to humans. 'Hunter-Gatherers' survived through exploiting resources of the forest but in the procedure exerted little manage in excess of their natural environment. They were omnivorous; the proportion of meat, plant food, etc varying from region to region. In the absence of apparatus human dependence on animal meat was limited, initially to scavenging and only slowly to hunting. All beside this stage human dependence on fruit and other plant food remained quite high.

Human dependence on forest witnessed a change with the introduction of apparatus, initially of stones (usually recognized as Palaeolithic apparatus) but soon also made of wood, one of the mainly versatile raw materials recognized to humanity. Unluckily, timber rarely survives in the archaeological records and we are left mostly with stone apparatus as proof. Introduction of flakes, choppers, and later on axes influenced the human-forest interaction. They were multipurpose relics, used for grubbing up roots, working wood, scraping skins, and especially skinning and butchering big and little game. Through analyzing the geographical site of the locations of tool industry scholars have suggested that the hand axe was in information a form of primitive discus used primarily for hunting purposes.

Forest also provided shelter to the humans. Traditionally it was trees that provided shelter though with the growth of terrestrial version rock shelters became an alternative. Even today we have evidences for this type of subsistence. Varied ecological niches in these ecosystems are exploited today through traditional ethnic groups (tribes/adivasis) whose economies are geared to hunting and gathering, riverine fishing, marine fishing and shifting farming.

Typical examples are those recognized 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 manners of food procurement notwithstanding the information that they are now integrated into village economies. Since big game is now both scarce and its hunting is prohibited, they hunt little game and birds, and collect insects and honey and wild plant foods. The information that Stone Age occupations happen within the tribal habitats designates that the game and other forest foods now exploited necessity have shaped the survival base on a much superior level.

Ancillary Product

With the development of agriculture as source for food, the connection flanked by man and forest underwent a drastic change. For the agricultural civilizations, forest assumed secondary location. Though, one should be careful to realize that the shift to agriculture was not a quick procedure neither a smooth one. Initially agriculture was a risky proposition and forest resources provided sustenance in case of crop failure. At the similar 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 rising shift towards agriculture necessitated sedentary life approach, that too usually absent 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 significant characteristic of settled agriculture was the emergence of stratified civilization. Deal had been another marked characteristic of the agriculture civilization.

All these factors supported greater demand for the forest resources. Growth of agriculture, sedentary life-approach, and greater possibilities of surplus generation increased the demand for energy. At one stage the demand for energy was met through utilizing the draught power of animals and on the other hand it increased the demand for fuel-wood. Both the situations

demanded greater utilization of forest resources, as fuel-wood and as fodder. The arid leaves from the forest were used as manure for agriculture. As distant as food was concerned, with the growth of agriculture, forest products were ascribed secondary location. Though, 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. Likewise forest gave gum, resin, lac, honey, rubber and querns which were used through humans in several day to day behaviors.

Wood was one forest product that was extensively used as raw material for housing, furniture, agricultural apparatus, 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 structure/ home in a cost effective manner. Likewise, wood was extensively used to give beam for the construction of windows, doors and other openings. Wood was also required for construction of bridges, carts, and chariots. Mainly of the apparatus used in the agriculture sector were made of wood. Good excellence wood was required for the preparation of plough and other materials.

Conservation Practices

The importance of timber had grown enormously. Wood had multiple usages ranging from use as the vital source of energy, to a key ingredient of furniture and apparatus, particularly agricultural apparatus. As the culture progressed the require to conserve such an significant and critical forest resource became more and more apparent. Moreover the forest was also giving several other products which too needed to be conserved and judiciously used. The policies adopted through dissimilar states often reveal their anxiety as also the events initiated in this regard. Here we are giving some motivating conservation episodes from the region of Rajasthan which have mantled the robe of cultural practice in the region.

The attitude towards tree conservation is reiterated in the following anecdote written through Nainsi, in the Seventeenth century. King Maldevji

got *babool* trees of Merta cut. In response to this, and through method of revenge, Viram Deo said that he would cut the mango trees of Jodhpur. Though, people advised him not to do so as trees were to be protected. Hence he chipped a little branch of Mango tree symbolizing that he had settled the explanation. In this anecdote, the chief is restrained from cutting trees through his advisors. The latter almost certainly realized that denudation of trees would cause irreparable damage.

Another significant instance in this regard was the representation of *khejari* tree in the official flag of Bikaner kingdom in the Seventeenth century. Flags in medieval India usually 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. Likewise, concern for vegetation was visible in the construction of *bund* Jaitsar, close to 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 face where a garden was planted. A little canal with sluices was also provided to carry and manage the water from the *bund* to the garden. This reservoir could contain water for four to five months only. Though, the moisture retained through the ground was enough to sustain the garden round the year. Moreover, the arid 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 local environment and socio-religious practices. The social concern for environment in medieval Rajasthan manifested itself in several shapes. 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. Mainly 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 recognized 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 throughout droughts, would reduce the means of livelihood. Likewise, the cutting of green trees was prohibited, as it would reduce the availability of green fodder for the animals. It became more significant in this region where natural vegetation was extremely thin and sparse. Jambhoji's teachings, congruent with the interests of the general 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 through Bishnois in 1752 VS (AD 1696). Likewise, in 1878 VS (AD 1821), Man Singh the king of Jodhpur issued a same order with respect to *khejari* tree.

The founder of the Bishnoi sect was not alone in attempting to power conduct towards livelihood beings via religious and ethical transformation. Another popular saint, Jasnathji (AD 1482-1506) who was a modern of Jhambhoji also endorsed such a viewpoint. His followers were recognized as Jasnathi. Like his modern 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 extremely sparse; there were extremely 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) in relation to the 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. Alike cases were accounted from numerous villages and *Qasbas*. *Patel* (headman) of village Kharkhura was punished in 1780 VS. (AD 1724) for the similar 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 region. 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 manage enjoyed through the state with respect to vegetation.

Neem having tremendous medicinal properties, needed protection. Being a medicinal plant, it was measured inauspicious to cut *neem*, therefore, punishment. Likewise, cutting the tree of *peepal* has been accounted from village Chandpur *pargana* Bhartri in 1775 VS. (AD 1719). Ritually, the tree of *Bad* was measured auspicious, hence attempts to axe the tree were punished through rulers as accounted from village Chauroti, *pargana* Hindaun in 1785 VS (AD 1729). Moreover the trees of *peepal* and *Bad* were worshipped through women of the royal household. Therefore, perhaps religious thoughts were an added justification for the enactment of punishment. Alongside, we have proof 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 circumstances 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 measured 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 significant for the military as cattle and horses used in warfare needed fodder. The primary source of draught and transportation was cattle and their require for pasture played an significant role in state policies. State used to actively procure the grass and uphold a reserve stock. for the cavalry- horse, camels and elephants- the mainstay of their army.

METAL & MINERAL RESOURCES

Metal Resources

Metallurgy is one of the oldest applied sciences. Its history can be traced back to 6000 BC when its form was rudimentary. Though, to gain a perspective in Procedure Metallurgy, it is worthwhile to spend a little time learning the initiation of mankind's association with metals. Currently there are 86 recognized metals. Prior to nineteenth century only 24 of these metals had been exposed and, of these 24 metals, 12 were exposed in the eighteenth century. So, from the detection of the first metals - gold and copper – until the end of the seventeenth century, only 12 metals were recognized. Four of these metals, arsenic, antimony, zinc and bismuth, were exposed in the thirteenth and fourteenth centuries, while platinum was exposed in the sixteenth century. The other seven metals, recognized as the Metals of Antiquity, were the metals upon which all early civilizations were based. These seven metals in the descending order of their detection 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 recognized to the Mesopotamians, Harappans, Egyptians, Greeks and the Romans. Of the seven metals, five can be establish in their native states, e.g., gold, silver, copper, iron (from meteors) and mercury. Though, 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 significant that the metal deposit necessity be recognized. In the case of the first metals color was the mainly significant factor as it allowed the metal to be recognized in nearby rock, stones, gravel and dirt and separated from these. Separation was then the after that problem followed through concentration. These three steps are extremely significant 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 accepted out simultaneously.

Gold

Gold articles are establish extensively in antiquity mainly as jewellery. Early gold relics contain important silver contents. Man learned to convert gold into jewellery and ornaments, on the foundation of knowledge that it could be shaped into sheets and wires easily. Though, 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 establish in two kinds of deposits: lode deposits, which are establish in solid rock and are mined by conventional mining techniques, and placer deposits which are gravelly deposits establish in stream beds and are the products of eroding lode deposits. Since gold is establish uncombined in nature, early goldsmiths would collect little nuggets of gold from stream beds etc., and then weld them jointly through 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 significant metals in daily life.

Copper

The use of copper in antiquity is of more significance than gold as the first apparatus, implements and weapons were made from copper throughout the Chalcolithic era. Through 3600 BC the first copper smelted relics such as copper rings, bracelets, chisels were establish in the Nile valley. Through 3000 BC weapons, apparatus etc. were widely establish.

Malachite, a green friable stone, was the source of copper in the early smelters. Earlier it was idea that the smelting of copper was the result of a chance dropping of malachite into campfires but that was establish improbable due to low campfire temperatures. It is more probable that early copper smelting was exposed through ancient potters whose clay firing furnaces could

reach temperatures of 11000-12000 C. If Malachite was added to these furnaces copper nodules would easily be establish. Although the first smelted copper was establish in the Nile valley, it is idea that this copper was brought to Egypt through the Gerzeans and copper smelting was produced first in Western Asia flanked by 4000 and 4300 BC. Although copper can be establish free in nature the mainly significant sources are the minerals cuprites, 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 information, through 2500 BC the Sumerians had recognized that if dissimilar ores were blended jointly in the smelting procedure, a dissimilar kind 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 detection of bronze. Bronze was a much more useful alloy than copper as farm implements and weapons could be made from it. Though, it needed the detection of tin to become the alloy of choice.

Native tin is not establish in nature. The first tin relics date back to 2000 BC. Though, it was not until 1800 BC that tin smelting became general in western Asia. Tin was reduced through charcoal and at first was idea 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 mainly commonly alloyed to copper to form bronze. The mainly general form of tin ore is the oxide casserite. Through 1400 BC bronze was the predominant metal alloy.

Silver

Although silver was establish freely in nature, its occurrence was unusual. Silver is the mainly 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 alike to gold, native silver can easily be shaped.

Galena always contains a little amount of silver and it was establish that if the lead was oxidized into a powdery ash a droplet of silver was left behind. Another development in this procedure was the detection that if bone ash was added to the lead oxide, the lead oxide would be adsorbed and a big amount of material could be processed. Through 2500 BC the cupellation procedure was the normal mode of silver manufacture.

Iron

Iron was available to the ancients in little 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, though, iron-creation did not become an everyday procedure until 1200 BC. Hematite, an oxide of iron, was widely used through the ancients for drops and ornaments. It is also readily reduced through carbon. Though, if reduced at temperatures below 700°-800° C it is not appropriate for forging and necessity be produced at temperatures above 1100 °C. Wrought iron was the first form of iron recognized to man. It is motivating 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 similar for farming. Iron and steel became the structure block for culture. Interestingly, an iron pillar dating to 400 AD., remnants standing today in Delhi, in Qutab Intricate. It is made of forged iron and corrosion to the pillar has been minimal. Iron is rarely establish in its native state. The only recognized sources of native iron are in Greenland where iron occurs as nodules in basalt that erupted through beds of coal and two extremely unusual nickel-iron alloys.

Lead

Lead is not establish free in nature but Galena (lead sulfide) was used as an eye paint through the ancient Egyptians. Galena has a extremely metallic looking appearance and was, so, likely to draw the attention of early metalworkers. The manufacture of metallic lead from its ore is relatively easy and could have been produced through reduction of Galena in a camp fire. The melting point of lead is 327 C, so, 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 approximately 3500 BC Lead is highly malleable, ductile and non-corrosive creation it an excellent piping material. Lead pipes bearing the insignia of Roman emperors can still be establish.

Mercury

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

Historical Development of Metals

In World

The Sumerian municipality-states are measured as the first major metal-by culture. They navigated the Euphrates river for commerce, including the transportation of copper from Armenia to the north. At Gerza on the Nile

river presently south of the contemporary location of Cairo, the Gerzeans urbanized a culture based on the metallurgy of copper which they had learnt from Mesopotamia, in relation to the 3200 BC. The pyramids and other great structures of the Egyptian culture were built of stones that had been quarried and shaped by copper apparatus. While the rock used in the structures was establish nearby, the Eygptians mined copper in the Sinai Peninsula. The level 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 exposed. Close to these two copper ore minerals, the early prospectors often establish another copper mineral, blue-green turquoise. Turquoise is still prized approximately 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 establish to this day in the Sinai.

Copper reached the island of Crete from Egypt. A copper axe from in relation to the 3000 BC was establish on the floor of the ruins of a home. Egyptian barges accepted copper to the western coast of Asia Minor, where they traded for the well-known cedar wood from what is now Lebanon. Ruins of the Cretan culture hold relics with Egyptian power, such as fresco painting, pottery, and stone statuettes. Though, the form of the metal objects is more like that from Asia Minor. Metallurgy from Asia Minor reached Cyprus in relation to the 2600 BC. Egyptians traded fabrics and gold for copper from Cyprus. Myceneans settled close to the copper deposit locations in Cyprus.

Early metal-smiths of Sumer, Babylon, and Egypt were highly prized members of their civilization. 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 deal unions in history. Bronze, came into use at in relation to the similar time in Asia. Bronze relics dated at 3600 BC have been establish in Thailand. Copper is establish scattered approximately East Asia. Tin is

establish in the peninsula of Malaysia. Chinese written records date the first copper mining at in relation to the 2600 BC. and the first casting of copper vessels at in relation to the 2200 BC. The Shang dynasty's capital of Anyang in northern China had a bronze-casting industry in 1400 BC.

In India

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

Copper/Bronze

The copper workings in India have an antiquity dating back to the second millennium BC. They are accounted from Barudih in Singhbhum. We also have a little finger ring exposed at Babri, Birbhum, West Bengal which has been shaped from the chalcolithic stages and is dateable to in relation to the 1000 BC. It appears 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 civilization copper apparatus were used to help cut stone apparatus in a finer manner. The Harappans practiced alloying of copper and tin so that a more strong metal, bronze would be available. "Whereas 70 percent of analyzed copper artefacts from Mohenjodaro and Harappa have been establish to contain one percent tin (almost certainly the similar as establish in the natural ore), the remaining 30 per cent had tin ranging from 8 to 12 per cent, which designates that tin was here deliberately mixed with copper. The proportion of bronze within copper artefacts increases significantly with time at Mohenjodaro, and this was almost certainly the case in the Indus culture usually. Nickel, arsenic and lead were also used as copper alloys.

The ore for smelting copper in the Harappan civilization was mainly likely obtained from Rajasthan and Baluchistan, though Afghanistan and Persian sources too would have made the supply. "Copper was smelted in brick-lined pits, and wax-and-clay moulds were almost certainly used to cast whole or parts of copper and bronze artefacts. These incorporated apparatus such as razors, knives, chisels, hooks, sickles, saws and axes... Smaller copper apparatus contain awls, nails, needles and tubular drills.... A considerable number of copper and bronze utensils suggest that at least richer households could now use metal ware in addition to the breakable pottery". The Chalcolithic cultures, other than the Harappans, also used copper for creation dissimilar artefacts. A content analysis of these artefacts reveals that the chalcolithic metallurgical traditions and the Harappan custom had separate identities and the probability of any direct transmission is precluded.

Iron

The studies focusing on the history of introduction of iron in India had earlier whispered that iron was introduced flanked by 600 and 700 BC. But the discoveries made at Painted Greyware (PGW) locations has now settled this date approximately 1000 BC. D.K. Chakrabarti has written a comprehensive job dealing with the detection and use of iron in India. Some of his main findings may be given here to understand the use pattern of iron:

- The probable date of manufacture of iron in India is c 800 BC;
- The use of iron in India is earliest accounted from Central India and South India;
- These manufacture centres were situated secure to the regions from where ore was establish;
- There was a stability in custom of iron metallurgy up to the pre-industrial era; and
- Any correspondence flanked by the Indian iron apparatus of the earliest era and the West Asian apparatus was lacking.

Zinc

India gives the earliest proof 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 existed in the fourth century AD, describes both the manufacture of brass through the well-known cementation procedure, and of metallic zinc. Furnaces (*Koshthi*) have been establish at the ancient mines of Zawar in Rajasthan.

The Zawar mines from where zinc was extracted are situated at in relation to the 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 were being mined flanked by the sixth and first centuries BC". This trend then sustained further and as we approach to medieval India we discover proof of zinc distillation procedure on a fairly elaborate level. P.T. Craddock specializes in the revise. We provide an extract from him explaining the procedure: "at first glance the Zawar industry is the mainly unusual phenomena, a fully fledged technology with neither antecedents nor successors—and apparently no contemporaries either, for even within India it appears unique.... Zinc required a much higher temperature and the total exclusion of air. The form of the Kosthi furnace for holding the retorts appears to have been inspired through the general spottery kiln. The arrangement is of course totally dissimilar, 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 composed beneath… the Zawar procedure was certainly one of the mainly sophisticated and technically exacting procedure urbanized in the mediaeval world, one hesitates to use the term 'pre-industrial', for surely this procedure, with its appreciation of scientific techniques and learning towards mass manufacture, should properly be measured as an early instance of an industrial procedure in the contemporary sense''.

It is apparent from the account that metals as a resource had approach to grip the civilization firmly through the time state formation in India began. Thereafter, it was a question of controlling the resources. It is not without

cause that the Magadhan state grew in and approximately Rajgrih which region was a important iron ore region.

Mineral Resources

To be classified as a "true" mineral, a substance necessity be a solid and have a crystal structure. It necessity 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. 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 granules are too little to see or are irregularly shaped the crystal structure can be determined through x-ray analysis and/or optical microscopy.

Chemistry and crystal structure describe jointly a mineral. In information, two or more minerals may have the similar chemical composition, but differ in crystal structure. Likewise, some minerals have dissimilar chemical compositions, but the similar crystal structure. Crystal structure greatly powers a mineral's physical properties. For instance, though diamond and graphite have the similar composition as both are pure carbon, but graphite is extremely soft, while diamond is the hardest of all recognized minerals. Minerals may be classified just as 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 comprises 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 general use of minerals through 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 extensive era the minerals in dietary form were used through man through experience.

REVIEW QUESTIONS

- How do you distinguish between animate and inanimate forms of energy? Discuss briefly their historical evolution.
- Examine the historical practices of use of water as a resource.
- What mechanisms did pre-modern societies in India adopt for water conservation? Elaborate.
- Discuss the various levels of interaction between man and forest.
- Discuss the introduction of bronze in Indian history and assess the significance of this process.
- The introduction of metals changed the life-style of man in a major way. Comment.

CHAPTER 5

Indian Philosophy and Environment

STRUCTURE

- Learning objectives
- Man-nature relationship
- Conservation through ages
- Review questions

LEARNING OBJECTIVES

After reading this chapter, you should be able to:

- Understand the man's place in nature
- Understand the universe and its attributes
- Explain the components of environment
- Understanding conservation
- Explain the Indian view of conservation

MAN-NATURE RELATIONSHIP

Man's Lay in Nature

The Indian custom spaces man alongside other creatures of the animal world and the world of vegetation. This is a important characteristic and we would prefer to dilate on the subject further. Man enjoys no pristine location though a whole lot of privileges get accrued to man through his intellect. Actually man's lay in nature/ environment is two fold – physical and the spiritual. The physical relationship entails interaction with all the other livelihood things and nonliving 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 through man. These rules of conduct specify the duties and obligations towards other livelihood species. The guiding principle in both relationships is that the environment should not be endangered due to the behaviors of man. There is an element of ethics

involved in this and man's lay in environment/nature is situated within the realm of this ethics.

The treatment given to the issue – man's lay in nature – in Indian philosophical traditions too distinguishes flanked by the physical and the spiritual or psychical, as suggested in some treatises. Since the physical relationship is principally determined through those necessities that sustain subsistence, such as food and livelihood environment, it is a relationship of providing for the material requires. Though, material requires and material wealth is two separate notions and these are clearly demarcated in the treatment of man's physical relationship with environment. Unlike the techno-contemporary objective of mastering environment for extracting the maximum of material possessions, the Indian custom 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 thought 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'. Evidently man is conceived in Indian custom as on behalf of a microcosm of the superior universe which is the macrocosm. Interestingly the two – micro and macro-cosm – constantly swap their shapes. Therefore fire of the nature becomes speech as it enters the mouth; the sun becomes sight as it enters the eyes; wind becomes breath through 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 designates man's and nature's interdependence as also the reality that the two can be comprehended totally 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 colors – the firm

earth, the earth protected through the deity (Indra), upon this earth I – unconquered, unslain, unwounded, have set my foot.

Srsti/Universe and its Attributes

The configuration of environment in Indian idea is expansive enough to contain the whole Universe within itself rather than being locative or temporal in character. A more commonly used word for this is *Srsti*. In Indian idea *Srsti* is conceived as a livelihood mechanism where humans beside with *Pasu, Paksi and Vanaspati,* are one of the several livelihood creatures and non-human shapes are not the lifeless entity as the physical matter alone. The concept of *Srsti* has been elaborated in conditions of its mobility where humans relate with *Srsti* continuously and the concept is so continuously redefined. Here one can read an effort at trying to understand and relate to the greater 'whole' of the nature. In this procedure emphasis on version has been one of the guiding principles for an interaction flanked by 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 dealings flanked by these two in scrupulous and in the middle of other components of *Srsti* in common. At the similar time man has been measured as the mainly intelligent creature and so it is imperative upon humans to ensure a peaceful coexistence with other livelihood creatures as well as with non-livelihood material world.

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

Indian philosophical traditions have urbanized a cosmic vision that is cyclic in nature. The cycle begins with creation and is followed through continuance that finally culminates in destruction; and then a new cycle begins. It suggests that every material substance/creature is perishable with the

possibility of regeneration. The fragility of the environment has also been cautiously stressed in such discourses. Traditional ideas have proposed a set of *Trinity* i.e., the Creator, the Preserver and the Destroyer. The Vedic custom 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 motivating to note that *Brahma* is recognized as the *Purusa* who is all - pervading and is the supreme cause for all subsequent creations. This *Purusa* is also separate from all that he created. The *Rigveda* also speculates on the world beyond the moment of creation. Many dissimilar names attributed to the creator indicate that the origin of the world is not unidirectional inspite of the information that origin is always attributed to the God or creator. This also comprises 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 Vedic theory was further expounded through Bhartrhari" say Dwivedi and Tiwari. The sage "discussed the *Vedas* and *Puranas* as visualizations of the divine power in Vedic languages. A number of Rigveda hymns are in worship of inspired speech (*Vak*), measured a creation of God".

- Upanasadic theory of creation suggests that Purusa makes matter out of itself and then enters it as the first born. Purusa Prajapati, makes the waters, enters into them as an egg in order to be born from them, and issues forth from them as Brahma.

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 described *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 lay. The theory of creation, just as to *Gita*, has been mainly elaborately expounded in the *Santiparva* of Mahabharata. Yudhishthiva and Bhishma converse in relation to the *Srsti* and the procedure of its creation: "Yudhishthir asked Bhisma Pitamaha – How was the world created? What was the location 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 all creatures are made, how cleanliness and impurity appeared, and how *dharma* (religion) and *adharma* came into subsistence. 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 recognized as *Manas Purusa*".

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 subsistence. 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 described *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*) is the hands". Gita sums up the situation through declaring that the *Brahma*, created the *Srsti* and decided to protect it and to rectify its malfunctioning through appearing as Vishnu in several incarnations to set things right. As stated in the beginning *Srsti* is created to give a stage to all its creatures to perform their assigned roles and then vanish into oblivion. In this procedure the supreme power undertakes to make *Srsti*, maintains it and then annihilates the whole creation. The universe therefore remnants totally dependent on the will of the supreme power. Krishna tells Arjuna in *Gita*:

- The whole cosmic order is under me. Through my will it is manifested again and again and through 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 excellence of *Sata*, the excellence of *Raja*, and the excellence of *Tama*. All livelihood creatures are infested with one of the three qualities and are in turn administered under the laws of God. Consciousness is another significant attribute which the livelihood creatures receive at the time life is breathed into them through God. *Srsti* is thereafter permitted to run itself. It is now apparent that the creation of *Srsti* and its attributes have a slight difference in the four theories. One may legitimately probe the cause for this variation. The vedic deities are usually classified just as to their natural features. 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:*** *Indra*, *Apam*, *Napat*, *Rudra*, *Maruts*, *Vayu*, Atmosphere *Parjanya*, *Apas* (the waters);
- ***Terrestrial Deities:*** *Prithvi*, *Agni*, *Som.*

The four theories provide precedence to one of the three attributes of nature in the act of Supreme manifestation in the form of *Srsti*, hence the variation. The variation 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 through dissimilar 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 through nature.

Components of Environment

This verse from Vamanpurana makes it apparent that in Indian idea environment has been visualized as an organic entity where all or mainly of

the components are linked with each other in a intricate web of inter-relationship. This idea also perceives that *there is life in all types of material or things*. Therefore subsistence of any of its components in separation is inconceivable. The emphasis on mutual dependence has been the guiding philosophy of subsistence in Indian custom. There cannot be any dichotomy flanked by the numerous components of environment. Mutuality is measured 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, forms primal matter into eight *tattvas* (elements): earth, water, fire, air, sky, mind, intelligence, and ego of which first five are measured vital elements. Approximately at the similar time the development of animal and human world provides rise to the emergence of five senses: sight, hearing, touch, taste and smell. The essential components of environment are the *tattvas* and the senses.

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 procedure of creation as well as the compositional characteristics of *Srsti*. The genesis has been attributed to procedures 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 features of five vital elements of *Srsti* we give a glimpse into their nature and significance as described in the treatises. There is a chronology of appearance that begins with sky. Sky is measured to be the first in the middle of all the five elements. It is also recognized through conditions like, *Dyauh, Svah, Akasa, and Kham*. As we approach to water, that

is after that in importance, we discover *Rigveda* considering water great and all-pervading. Water is measured 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) approach to me, jointly with life's breath and lustre.

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 tranquility to thee.
- O Man! Sweet is 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.

This verse from *Atharvaveda* is important from another point of view. It invokes the propitiatory attributes of water and proposes that these be bestowed on *Man*. It therefore brings *Man* at the centre of *Srsti* and spaces at least one of the five cardinal elements at the disposal of the *Man*. The relationship of interdependence is missing and its lay is acquired through the characteristics of appropriation even if in rudimentary form. Water is ascribed many qualities. In a text described *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 substance the effect shows.

Philosophical traditions of India provide the after that (third) location to (Air) *Vayu*. It is also measured as *prana* of all the livelihood creatures. It has been suggested that the body of all the livelihood creatures can be sustained only as extensive 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.

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. After that 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 livelihood beings. *Prithvi* requires 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 provides us land to produce food granules 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 through the cloud, and loved through the rain, …may God, the lord of life, make our motherland, who all valuable things in her womb, pleasant to us on every face.

The special significance given to *Prithvi* is easily forthcoming from these two verses. It is recognized mainly unambiguously that *Prithvi* as mother gives all the necessary means of the sustenance of life. It should so be prayed

so that the possessions do not dwindle and it should be revered so that the value of these possessions is not obliterated from our idea. It is also significant to note that in this custom the fruits of the earth and its bounties are not declared as the sole belonging of the humans. In information they are for all shapes 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.

Popular and Classical Traditions: Symbols of Environment

The nature/environment in India is represented through two dissimilar but related traditions – the popular and classical. While the reflections of the popular traditions are more visible in practice, the classical or textual custom offers a complete and systematic analysis of the universe. It is an motivating information that the popular custom is mostly preserved in oral, non-textual form in an uncodified manner. Oral traditions therefore constitute a vital method through which we approach to know in relation to the knowledge which has not been organized and codified. They also help us to understand those civilizations for which we have extremely limited textual information. Day-to-day practices and methods carry the glimpses of ancient past. In oral custom in India, *environment has been perceived in a symbiotic relationship with the humans where environment is also measured as a livelihood organism which breathes, feels, and possesses sensory perceptions*. Several components of environment in this relationship either acquire or have been accorded special positions. At times these special thoughts are also ritualized.

The trees and animals are one of the vital components of popular folk tales which are part of the popular oral traditions in India. Moreover several attributes of animals are also recognized and are used as if they are natural sensory features. The flora has been part of the themes of dissimilar stories. It is always kept in mind that human survival is possible only with the conservation of whole flora and fauna. This understanding is also reflected in

the religious practices as dissimilar animals and plants are worshipped at dissimilar times so as to ensure their survival. Popular traditions consider nature as a reality of which man is an inseparable part at all stages. The myths do not provide man a unique location in as distant as his origin or his location with respect to other creatures is concerned. It is usually whispered in the popular custom that knowledge came to humans from birds and animals. Man is not the creator of knowledge. Cosmic intelligence is measured 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 lived 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 characteristics of human life were placed in an integral vision of environment in the ancient Indian traditions. The classical traditions conceive environment as a organization with intricate inter-relationships of numerous livelihood and non-livelihood entities. Even the non-livelihood organic world has been perceived as a livelihood creature with a soul. It was a extremely important concept as it placed man as equal to every other element of our environment as has been repeatedly stressed. To highlight the importance of several components of environment, several rituals have been institutionalized. These rituals ensured that we treated even the non-livelihood world with great care and maintained a harmony with it. For instance fire is conceived as messenger of God. Earth has been measured as mother goddess. Sky is worshipped as father.

The non-human livelihood world has been given great attention in Indian philosophic idea. There is a whole custom of anthropomorphism, where several types of plant and animal lives have been ascribed special location. The ancient custom of worship of *Pashupati Mahadev* is one such instance. The tales of *Panchtantra* may also be cited as another composition that highlights the special location given to non-human livelihood world. Animals are given human features of not only language but also faculty of feeling and intellect. Dissimilar attributes of animals have been recognized and are

extremely beautifully utilized in these tales. Indian philosophical idea also highlights the numerous species of flora and fauna and their special location vis-à-vis environment. This all– encompassing view is a great attainment. The similar enveloping view discovers reflection in man's visual expression of perceived reality. The Indian custom looks at this perceived reality as imbibing three composite characteristics, each involved in the other and each orienting the other. The order of priority goes like this;

- The first lay 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 discover an occasion to take environment into their consideration. The term they use for it is *loka* which means the world in all its infinite diversity of livelihood and non-livelihood beings. In Indian philosophy it is usually whispered that each creative act comes from direct get in touch with *prakriti* (nature). The language of the artistic manifestation evolves through the visual and audio perceptions of the objects in nature. Even the negligible sprout in nature becomes the artist's greatest joy. In celebrating nature nothing is measured as useless. The art form becomes a livelihood entity, a part of the self, family, village and that method, 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 procedure of cyclic creation, degeneration and regeneration and finally of enlightenment. His energy is *Sakti*. Without her he is partial. She herself, the daughter of the *Himalayas*, necessity undergoes penance and austerities. The emphasis here is on discipline and austerity, with greater integration of environment.

Pollution (*Pradushana)*: Traditional Concerns

Traditionally, the environmental vision in India has been conceived in conditions of a universe which is a creation of God and so, a definite set of rules appears to govern the universe. These rules are there for every livelihood creature to follow, though, 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 idea 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 measured as an act to ensure the continuance of order and flourishing of civilization.

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-subsistence in the middle of the creatures or material world was measured as *pradushan.* The prime cause of *pradushan* has been recognized as human greed and selfishness. Polluted *Srsti* has been described in the following conditions: It appears that all stars, planets, moon, sun, air, Agni and nature or directions have been polluted. Seasons also appear to job 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 happen human beings will suffer from diseases. Due to pollution of seasons, many kinds of diseases will crop up and they will ruin the country. So, collect the medicinal plants before the beginning of terrible disease and change in the nature of Prithvi".

The source of *pradushana* has been explained in conditions of non-adherence to the set norms of cleanliness, violation of *maryada* (code of

conduct), etc. Cleanliness was greatly stressed in the traditional ideas. 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 revitalizing and strengthening it will not be efficacious as the dirty clothes will not take proper color. Indian traditional idea stressed on the prohibition of any such action which had the impact of disturbing the natural symphony or causing contamination of any of the elements of the earth. Anybody violating common norms of cleanliness and hygiene was liable to be cursed. Clearly tampering with the environment to generate disharmony was *pradushana*.

CONSERVATION THROUGH AGES

Understanding Conservation

Conservation of environment does not and cannot have a universally accepted definition. Usually conservation is measured as protection of wild nature where as few see it as an effort to stress the prudent use of already stressed natural possessions. In information as the human concern in relation to the nature has grown so have the definitions evolved. Usually mainly accepted definition presented at the *World Conservation strategy* through the International Union for Conservation of Nature and Natural Possessions 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 requires 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 use and habitat modification which may be leading to an excessive biodiversity loss. Therefore conservation is not basically preservation of wild nature or biodiversity but it also encompasses the superior issue of the usage of natural possessions. At the similar time it also implies *preservation of some stage of biodiversity that is essential to the functioning of the ecosystems and the survival of the mankind beside with other livelihood creatures.*

It is usually whispered that nature has its own method of functioning and there is an unsaid balance maintained through nature flanked by humans and its possessions. It is only now that greater use of natural possessions 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 through those who have become disillusioned with the course of development. The debate has superior political dimension and it is whispered that Northern countries (Urbanized Countries) after developing their industry and in the procedure destroying the natural balance are now forcing the Southern countries (Developing countries) to not develop in the name of conservation of environment and natural possessions in scrupulous. It has been pointed out that the stage of energy consumption enjoyed through Northern countries is not tenable in the absence of enough natural possessions. This view was mainly vehemently argued at the U.N. Conference on the human environment in Stockholm and Northern environmentalists were shocked in 1972 through the positions taken through the South.

Politics separately, it is a matter of concern that all are threatened through the decay of global life support systems. Historically, people in industrialized countries have not perceived the importance of environmental conservation the similar method 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" kind 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 job. The 1987 statement of the *World Commission on Environment and Development* reflects both views. There is a new synthesis arising in the middle of world political leaders as well. In the middle of the populace the differences flanked by North and South are diminishing. Northern workers are becoming more politically active with respect to the danger their job has on environments, while Southern people are

gaining a broader understanding of the importance of ecological systems and procedures for economic development.

Conservation is essential for the survival of humans as well as life shapes on earth. Subsistence of life shapes on earth has been made possible through a extremely intricate combination of interaction in the middle of innumerable factors. The mainly significant in the middle of these factors being the atmosphere, which symbolizes availability of air (oxygen), water, sun, land shapes in scrupulous and numerous other materials. It is presumed that any big level disturbance in the availability or functioning of any of the components of environment would lead to environmental decay and ultimately cause extinction of life. So, conservation of not only the quantity of the components but also the excellence of the components is also extremely significant. As such plants are measured as the primary producers but their relevance with respect to generation of oxygen cannot be undermined. So, 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 similar time we necessity be careful to note that till date we are not able to identify numerous other factors that also power the environment.

Sure characteristics 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 realized that impact of pollution on humans can not be treated in separation and we have to extend our concern to other life shapes also. Another related but equally relevant aspect of conservation has been its economic value. Mostly it has been realized in conditions 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 big sections of humanity. The similar is applicable to an unrestrained cutting of forest for petty gains. The deforestation would ultimately not only power 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 rigorous, defeating the vital purpose.

Likewise, beside with economic thoughts of conservation, we necessity realize the irreparable damage being caused to the aesthetics of environment. Greater the human technological penetration in the functioning of dissimilar components of environment it is hard to explain the real nature of environment to superior population and urban born in scrupulous. Conservation is also of great scientific value. Because relatively little is recognized in relation to the past, present and possible future of the earth, we require 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 possessions waiting for scientific investigations. Any possibility of elimination or pollution of any such natural resource will deprive humans of its possible benefits.

Indian View of Conservation

Cutting crossways historical, philosophical debates, the one principle which underlies and gives unity in Indian philosophy as also stability of vision and perception is the assertion that *Man is only one in the middle of all livelihood matter*. Man's life depends upon and is conditioned through all that surrounds him and sustains him, namely, inanimate, mineral and animate, aquatic, vegetative, and gaseous life. It is so, Man's duty to constantly remind him 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 in excess of 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 therefore civilization develop on the postulate of the perpetual movement of *creation, degeneration, and regeneration* of the cosmos. The traditional civilization is structured on a four fold manage organization that orders human life, its survival 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 described *purusartha*, that is, the creation of a cultural person (*purusha*). At a higher stage of consciousness, the cultural person is transformed into a cosmic person.

The Indian theory of nature and ecology is enormously affected through the theory of creation which recognizes that *every element, substance and livelihood being in the universe is created through the similar Supreme Being; and the man has no special dominion in excess of nature*. The early Indian socioreligious systems enshrine respect for nature in the following vital 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 give useful references ascribing practical conservation tips that directly relate with this enshrined respect for nature. *Vedas, Upanishads, Puranas* and other scriptures provide detailed descriptions of trees, plants and wildlife beside with their importance to the society. Trees have been measured as an essential part of Indian houses. 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 account 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 several trees and plants are used in religious ceremonies and worship. Some trees and plants are measured so sacred that it is assumed that scrupulous 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 several Gods. Names of several 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 several trees and plants are not only worshipped but cutting green trees has also been prohibited and punishments prescribed for the offender. Indian civilization had been extremely much aware of the information that *indiscriminate destruction of plants and forests would result in diseases and pollution of the atmosphere*. One of the early historical proof of this nature comes from the inscriptions engraved on pillars and rocks at the behest of Ashoka, the well-known 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 establish at Rampurwa in Bihar and issued through him in 243 BC gives elaborate injunctions relating to environment. This edict may even be taken as one of the earliest historical record focusing on conservation practices to be followed through people in common. The text of this edict reads as below (English translation):

- Therefore 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, manias, 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 much, are not to be slaughtered, nor their young ones which are less than six months old. Cocks are not to be Capone. Husks containing livelihood beings should not be burnt. Forests much not be burnt either uselessly or in order to destroy livelihood beings. The livelihood necessity not is fed with the livelihood.
- 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 after that, and invariably on every fast day, fish is exempt from slaughter and should not be sold. And on the similar 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 throughout 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 through me twenty-five times throughout the era in question.

The text of this edict is self-explanatory. It provides a list of creatures which were declared protected and it was forbidden to slaughter them. Injury to livelihood creatures in other ways was also prohibited. The conservation of forests was earnestly propagated. Forests as the livelihood abode of a diversity of creatures would help protect a diversity of species. The injunctions concerning fish were invoked perhaps with a view to protect them throughout the breeding season. For its date which is as early as the third century BC the edict is unparalleled in propagating conservation ethics.

The Indian civilization, in ancient and medieval times, provided a organization of moral guidelines towards environmental preservation and conservation. Environmental ethics as propounded through ancient scriptures and the seers sustained to exist in civilization and was practiced through not only general man but even through rulers and kings. These principles were properly knitted with the Indian method of life. Even extremely minor things creating environmental troubles were dealt with giving proper solutions.

We have many 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. Mainly 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 general 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 through Bishnois in 1752 vs./AD 1696. Likewise, in 1878 vs./AD 1821, Man Singh, the king of Jodhpur, issued a same order with respect to the *khejari* tree. King Takht Singh in 1900 vs./AD 1843 extended the scope of this legislation through prohibiting slaughter of any animal in the villages dominated through *vaishnoi.*

The founder of the Bishnoi sect was not alone in attempting to power conduct towards livelihood beings via religious and ethical transformation. Another popular saint, Jasnathji (AD 1482-1506) a modern of Jambhoji also endorsed such a viewpoint. His followers were recognized as Jasnathi. Like his modern, Jasnathji was also aware of the importance of the preservation of environment. In his teachings, the *jal* tree, which shaped 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 effort towards protecting their livelihoods. Though, restrictions through religious and official sanctions question the older assumptions of prudent use of natural possessions and environmental conservation as supposedly practiced through traditional civilizations.

Conservation Practices in History

Conservation has a chequered history. It has, in the extensive and coiled procedure, concerned itself with natural ecosystems and the animal world. Contemporary attitudes and practices in relation to the conservation have evolved mainly in the context of the socio-economic mores of western civilization. These attitudes have been influenced through the political and economic upheavals that western civilization has undergone. Western notions of conservation have been mainly guided through the philosophical foundations of Judeo-Christian location in relation to the man and nature. Two thoughts constitute the core of this location:

- The right of use of nature through man, unfettered through 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 use of nature is a natural legitimate pursuit. This view does not endow the environment and its inhabitants with protective spirits that prohibit use.

Starting with the voyages of detection in the fifteenth century, the power of European civilization was spread in excess of the world. Through the seventeenth century Europeans were equipped with an increasingly powerful technology and a rising skill to vary big regions of the earth. Throughout this era 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 extensive-term health and productivity of the newly exposed countries. Soil erosion as well as the destruction of natural vegetation and wildlife accompanied the spread of European colonization. Throughout the similar era, though, some conservation thoughts and practices were also being promoted. Forest conservation, for instance, urbanized sound beginnings because of the disappearance of natural forests as a result of the rising demand for wood fuel for industrial uses. Also a common interest in and concern for wildlife was developing.

The nineteenth century, though, witnessed unusually severe environmental use and destruction. In Africa several shapes of wildlife were hunted to extinction, and mainly of the superior mammals were reduced to numbers that endangered their survival. Even the superior predatory animals were almost exterminated, and some of them subsequently became extinct. Several kinds 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 augment to stages distant above what the natural forage could support. The procedure of in excess of foraging damaged the range lands to such a degree that they have not yet recovered. The grasslands were overgrazed and native vegetation was eliminated.

Through 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 through an evolving mechanistic view. This change is best exemplified through the emergence of the theory of *development through natural selection*, presented jointly through Charles Darwin and Alfred Wallace. The concept of natural selection replaced the creationist view of the original livelihood species with a mechanistic procedure of interaction within nature. *The evolutionary view also opened the eyes of several to the information that change in the environment, including changes caused through humans, could bring in relation to the extinction of several types of organisms, as the fossil record demonstrated.*

It could have been predicted that the contemporary conservation movement would have its beginnings not in the settled lands of the Old World but in those regions of the New World where, within the memory of a single generation, there had been extreme changes in the landscape and same changes in the abundance of wildlife. Conservation as a national movement was initiated through 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 period 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 through chemicals and chemical wastes. The emerging situation was frightening. The attention of world society to the issues related with conservation of environment was bound to be attracted through it. In the post-war scenario serious attention was paid to the issue. It was seriously realized that the global commons were being increasingly threatened through a wide diversity of real and potential environmental troubles. 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.

REVIEW QUESTIONS

- Write an essay explaining the place attributed to man in Indian philosophical doctrine.
- Explain the creation and characteristics of *Srsti* as exposed in Indian philosophy.
- Write a note on the significance of environmental conservation.
- Write an essay on the Indian view of conservation.

CHAPTER 6

Colonialism and Environment

STRUCTURE

- Learning objectives
- Understanding of environment
- Environmental agenda
- Resource management: forests
- Resource management: water
- Review questions

LEARNING OBJECTIVES

After reading this chapter, you should be able to:

- Understand the industrialism.
- Understand the colonialism.
- Understand the colonial environmental agenda
- Explain the forests and water resource management

UNDERSTANDING OF ENVIRONMENT

Industrialism: Environmental Discourse

Industrial Revolution was a momentous occurrence. It signaled a brake for the *biological regimes* and initiated a procedure of industrialization that was impregnated with enormous new possibilities of the use of natural possessions. Industrialization was accompanied through technological advances of distant reaching impacts and those jointly unleashed procedures that altered totally the prevailing picture of the natural world. Fernand Braudel had said: “In information, until the eighteenth century, a Jungle Book could have been written in relation to the approximately any part of the globe”. Within a century since then, though, echoes of wailing voices could be heard saying *How Green Was My Valley*?

England was a pioneer in industrialization. It was a special circumstance that had given England a location of eminence. Industrialization

was a intricate procedure that had got initiated there due to a peculiar combination of factors. The major regions that had approach under the splurge of industrialization were agriculture, demography, inland transport, technology, deal and industry. In information there was no sector of private or public life in England that was actually immune from industrialization. An understanding of industrialization and its working in England is so of help to us in gaining insights into the formulation of environmental perceptions of English colonizers.

Agriculture provided the necessary background against which the industrial changes unfolded. Experiments with soil usage and the introduction of a diversity of crops was perhaps the first stage where notable changes became apparent. The fertilizing properties of soil were enhanced through 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 dissimilar layers of soil. It is an motivating information that industrial and mechanized equipment in agriculture were introduced only approximately mid-nineteenth century. Braudel notes that changes in agriculture "approach not so much from machines or wonder crops as from new methods of land use; new timetables for ploughing; new shapes of crop rotation which eliminated fallow and encouraged grazing, a useful source of fertilizer and so a remedy for soil exhaustion; attention to new strains of crops; selective breeding of sheep and cattle; specialized farming for higher yields – all with results which varied just as to region, to natural circumstances and to the constraints of the market which were never the similar in two spaces. The resulting organization was what would in the nineteenth century be described *high farming…"*.

One of the early changes in the industrial sector was the introduction of coke as a fuel replacing charcoal. The mainly noticeable use of coke was in blast-furnaces for creation pig-iron. In "in relation to the 1760, the cost price of charcoal-fired smelting was in relation to the £ 2 per ton greater than that of iron produced through the rival method" the coke fired blast furnaces. The other important change was in the cotton sector where a manufacture boom began to illustrate through the secure 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 extremely soon all in excess of Europe, began through imitating Indian industry, went on to take revenge through catching up with it, and finally outstripped it. The aim was to produce fabrics of comparable excellence at cheaper prices. The only method to do so was to introduce machines – which alone could effectively compete with Indian textile workers.

But success did not approach 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 through the developing English industry – and it was a extremely big market indeed, covering England and the British Isles, Europe (where several continental cotton industries were though soon putting up their own competition), the coast of Africa, where black slaves were exchanged for lengths of cotton, and the vast 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; through 1850 this had risen to fifty per cent”.

An extraordinary expansion of English deal was one more characteristic of industrialization. After 1760 the English overseas deal continuously increased. The centre of gravity of this deal moved towards American colonies and India. Significantly this success, in mainly cases, was achieved through force. Beside face this, came improvements in inland transport. The Canal fever - as the development of navigable waterways is usually recognized as - began in 1775 and through 1830s wide and narrow canals had crisscrossed the whole country. The main intent was to facilitate haulage of possessions on a bulk level so that growth of English industries would not be stifled for want of natural possessions in the proximity of the locations of the industries.

These details point towards two conclusions. In the first lay industrialization resulted into a good deal of destruction, version 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 creation farmers to shift to forage crops. Since forage crops do best on light and sandy soils, these became the mainly productive land in England. Heavy clayey soils through contrast, previously regarded as the richest for cereal rising, and unsuitable for forage crops, were hit through the low prices created through higher yields in rival regions. Secondly, industrialism i.e. the version of an industrial mode of life, became the dominant social norm. In other languages, this meant a transition from a predominantly agricultural civilization to one in which manufacture dominated. The central discourse under industrialization was in relation to the revolution in the mode of resource use – transforming possessions from one form to another and creation it possible for possessions to be transported in excess of big distances, absent from the spaces of their origin.

Evidently the environmental perception or understanding of the English colonizers was mediated through this discourse. In the English understanding of environmental circumstances in India in the eighteenth century but especially since the battle of Plassey the following characteristics were quite dominant:

- The natural possessions of India needed to be elevated to the stage of commercial use in lay of the prevalent common practice of use for survival purposes;
- The resource-use practices needed to become free of any restraints so as to enable resource use;
- In this procedure, society manage in excess of possessions required to be unshackled even through legal mechanisms if needed; and
- A disagreement in the ways of life or cultures was deemed inevitable in this procedure.

Colonialism: Environmental Discourse

Colonisation of India was an occurrence of singular significance. The main colony in the world was created through the classic capitalist power. The extensive historical procedure, from in relation to the middle of the eighteenth century till the beginning of the twentieth century, was fraught with devices of

resource use of an unprecedented type interceded through an environmental perception that oriented possessions principally towards market. The colonial discourse on environment has been nicely elaborated through Alfred Crosby in his job *Ecological Imperialism: The Biological Expansion of Europe*. We use his argument here and split and paraphrase it to illustrate the consequences of colonial discourse on environment as below in row with our discussion:

- European colonizers exterminated native ecosystems and populations;
- The intricate of weeds, animals and diseases brought through Europeans devastated the flora, fauna and human civilizations of the colonies;
- It created 'Neo-Europes' that control the New World today;
- In this biological expansion of Europe there were three regions 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 regions more resistant to the ecological imperialism of Europe;
- Therefore '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;
- Portmanteau Biota (communal term for the organisms the colonizing 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 civilizations like India and China a dissimilar strategy had to be adopted;
- In India, the British could not make neo-Europes through decimating indigenous populations and their natural possessions base;
- But they did intervene and radically after existing food-manufacture systems and their ecological foundation;
- Moreover, through exposing their subjects to the seductions of the industrial economy and consumer civilization, the British ensured that

the procedure of ecological change they initiated would continue, and indeed intensify, after they left India's shores.

The English colonial manage 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 easy political procedure had grave and quite distant reaching implications. Irfan Habib describes the procedure and its meaning exquisitely: "The East India Company, which obtained this power, was controlled through the great merchant-capitalists of London. These merchants had so distant mannered a deal, based on the import of Indian piece goods (muslin, calico, chintz), silk, indigo and spices, that was financed mainly through the export of treasure. Now, suddenly, they establish 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 through treating the whole 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 organization of use – 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-described 'investments'. The purchase of these commodities in circumstances 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 deal; and, accordingly, the exports of Indian commodities underwent an enormous augment. 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".

Interestingly the profits so gained through English did not approach from commerce but were made available through the collection of land

revenue. Therefore 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 maximizing the land revenue. The results were terrifying as the agriculture was ruined. The colonial perception of the commercial use of possessions had acquiesced disastrous results. Throughout the era 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 in excess of Indian internal commerce and overseas deal obsolete, but positively required free deal… The English exports of manufactures, textiles in the first lay, not only practically wiped out the Indian exports of cotton goods, but also entered India to challenge Indian manufactures, in their house market….". The result was a second disaster; deindustrialization of India had been effected.

In relation to the mid-nineteenth century the capital investment at house 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 procedure had progressed up to a sure 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 flanked by India and its colonial conquerors, the English.

Conservation

It is usually argued that the age of detection and associated maritime travel gave rise to a new method of looking at man-nature connection. There were two types of major changes involved in this new vision. The first related to the emergence of a view that natural environment nearby the human civilization was pliable to man's desired changes. The second gave rise to a new type of significance being attached to nature that was also often imitated. The development of the thought of botanical garden was copied from Middle East. Through the time we arrive at the seventeenth century "a fundamental displacement of social and symbolic meanings absent from the confines of

religious contexts and into more secular settings" takes lay. Soon the "thought 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 diversity and richness, especially in tropical regions, became apparent and knowledge of it more widely disseminated in printed books".

The conservation efforts initiated in the colonies were the result of a keen awareness that had urbanized in relation to the an impending global scarcity of timber possessions. Though, none of these efforts could be connected directly to any methodical efforts at organizing 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 development therefore the environments of colonies sustained to suffer.

Richard H. Grove has studied the conservation practices of English colonizers in his book *Green Imperialism*. He writes: "The extremely early incorporation of conservationism as an accepted part of the role of the colonial state in India requires to be set in a broader context. There is no doubt that environmental sensibilities in Britain, for instance, were, in the middle of some groups, approximately as well urbanized through the 1860s as they were in the middle of the scientific services in India. They were extremely dissimilar types of sensibilities, and were associated with dissimilar types of social critique. The biota of Europe was basically not perceived as being threatened through rapid ecological change of the type that was taking lay in India. As a result, embryonic worries in relation to the destruction of rural landscapes and in relation to the species extinctions remained the concern of a mainly ineffective minority". It is not totally unfair to assume that environmental conservation as a policy was not on the principal agenda of the colonialists. Forest resource was their major focus. The depleted wood possessions back house in England was a blinker. It was not until the early years of twentieth century that serious attention was given to the issue.

ENVIRONMENTAL AGENDA

Colonial Environmental Agenda

Reviewing the book *Nature and the Orient* in the *Economic and Political Weekly* David Hardiman had written that the forest agenda of the British colonial powers was subjected to a critical enquiry in the book through protagonists arguing for and against the forest policy adopted through the British. The arguments centered round the current crisis of huge deforestation and while the forest policy of the British colonial era was held responsible for originating the current crisis, it was also contended that the similar policy sustained to be implemented approximately seamlessly in the post-colonial era. This actually was an extension of the location taken through Ramchandra Guha in his writings dating from early eighties (1973 and after). Guha's location was that "the British had recognized an autocratic forest department which sought to use timber for imperial requires through enclosing the forests and excluding the peasantry from by 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 era. With no substantial changes after independence in 1947, the protests sustained, giving rise in time to the Chipko movement. Guha was highly critical of the British, who in his explanation were blamed for both snatching the forests from the people and for providing the institutional base for their commercial use" (Hardiman). This location was contested "through the British scholar Richard Grove, who sought to illustrate that the original 'greens' in India were in information colonial officials. Colonial forest policy was, in his view, rooted in an enlightened understanding of environmental issues urbanized in scrupulous through a group of extra ordinary Scottish medicos serving in the colonies, which sought initially to understand the connection flanked by climate and health, but extremely quickly became experts in botany and ecology. They argued that there was a secure connection flanked by 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 through active management and manage" (Hardiman).

It is apparent from the positions taken through 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 possessions were valuable natural assets on which the state possessed absolute proprietary rights. The logical extension of this premise was that the societies exercising traditional rights in excess of forests were not justified in their claims and should be de-legitimized from such claims in order to protect the forest.

The procedure of extensive use of wood as a forest product had begun in England earlier than Industrial Revolution. But this procedure was hastened approximately mid-eighteenth century when use of charcoal was practiced on an extensive level as fuel to run blast furnaces. Through the third quarter of eighteenth century the forest situation was beginning to seem grim as vast regions were denuded of all forest cover. Since the well-known oak forests of England had been exploited to the extent that even their traces had begun to vanish, excellence timber was an urgent requirement. The maritime expansion and wars in the middle of colonial powers for grabbing as big a slice in global wealth as one could manage had maintained a constant pressure on ship structure industry. India as a colony was so a mainly opportune possession for England. One major pressure on English colonizers was for procuring timber for ship structure. In this situation Indian teak was exposed as a product of excellence and durability. The worth of Indian timber may be had from the common perception that England was saved in war with Napoleon due to a regular supply of teak timber from India. As stated through 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 through the legendary Maratha admiral Kanhoji Angre".

Another factor responsible for the use of forest was the expansion of railways in India. A stage of laying railway rows all crossways India that began in the second half of nineteenth century needed a extremely big number of sleepers for providing the foundational base for placing the railway tracks on it. The sub-Himalayan forests of Garhwal and Kumaon were totally denuded. The destruction was also the consequence of a policy of felling trees without accurately estimating the requirement of sleepers. Big number of felled trees in information rotted at the felling location 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 almost 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 close to railway rows in peninsular India, were extremely 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 – in excess of 6,500,000 deodar sleepers were supplied from the Yamuna forests alone flanked by 1869 and 1885".

Further, the orientation of the revenue policy of English colonial power also resulted in the destruction of forests. The objective was to augment farming and therefore enhance the revenue collection of the State. Forests were then treated as unnecessary obstacles in the method of agricultural expansion. The agenda of the English colonial power was clear as its main objective was to produce big commercial timber. The forests were ruthlessly subjected to this commercial aim. The other objective was to augment the volume of revenue collection. Forests were again treated with disdain as the act of agricultural expansion cleared big regions of all obstructionist wooded growth. In this scheme forest dwellers were to become great sufferers. A note reproduced from the *Bombay Gazette* through 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.

Through one direful stroke of pen the poor tribal discovers 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 types especially reserved, he is taken absent 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 necessity be stopped, that intoxication is a great sin, which cannot be allowed under a moral British raj, etc."

Post-Colonial Situation

Analyzing the colonial environmental policy, Gadgil and Guha made a pithy remark: "If in the neo-Europes, ecological imperialism paved the method for political consolidation, in India the causation ran the other method, their political victory equipping the British for an unprecedented intervention in the ecological and social fabric of Indian civilization. Moreover, through exposing their subjects to the seductions of the industrial economy and consumer civilization, the British ensured that the procedure of ecological change they initiated would continue, and indeed intensify, after they left India's shores".

In row with this remark the forest policy of self-governing India has truly sustained the vital working concepts of its predecessor, the English colonial power. There are four operative regions where this characteristic is clearly manifest. A extra ordinary 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 lay any change in the ownership of forests. The monopoly set up through the English in excess of Indian forests and the usurpation of the sole right in excess of its possessions has sustained 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 manage through legitimizing national priorities as of precedence

in excess of local priorities. The settlements on the fringes of forest rows are depossessed of claims in excess of the neighbouring forest possessions. The forests are declared a 'national asset' and state manage declared as in the interest of the whole country. "The rationale for government ownership is the belief that private individuals and groups will not invest in tree crops whose gestation era often exceeds a lifetime" of the individual.

A second characteristic relates to the stability of manage in excess of forests through 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 use of forest continues even in self-governing India. The colonial orientation of forest as a revenue generating possession continues in the similar manner in the post-colonial state. There is therefore a tendency to in excess of use the forest. As suggested through 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 several diversities of oak, so crucial for sustaining Himalayan agriculture, only merited a single bibliography".

Finally, the social groups which are intimately linked with forest do not appear to possess any extensive-term interest in the upkeep of forest possessions. The situation is appalling in view of the information that the forest management does not leave any scope for such social groups to benefit in any method from the forest possessions. The "bureaucratic tools, with its diffusion of responsibility and lack of any accountability, gives no motivation to a good officer for the proper management of possessions under his charge, or disincentives fro those who mismanage".

RESOURCE MANAGEMENT: FORESTS

The Pre-Colonial Background

In order to understand the dynamics and undercurrents of colonial impact on the understanding of forest as a resource, we require to understand

the strands of human utilization of the forests in the preceding era. The era from in relation to the 500 BC to 300 AD saw a big advance of agricultural land in excess of rich forest region both in the northern India and the river valley regions in the peninsular India. Greater agriculture meant superior availability of surplus. Therefore tribal chiefdoms started giving method to big states; Mauryas and Kushanas in northern India, the Chalukyas and Sangam Cholas in south India. The ground for further use of forest possessions lay in the logic of the empire structure exercise. With technological limitations, the only viable alternative for enhancing surplus lay in bringing more land under farming. Of course deal was also coming up in a big method but then the ships and boats had to be built out of the forest wood. Another method out was incorporating other territories, which described for better weapons of war. Elephants assumed significance, and elephant forests started coming up. The number of cities increased and the homes 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 action. Chanakya says that Brahmanas should be provided forests for plantations, for religious learning and for performance of penance.

Upanishads and *Aranyakas* were the major ones. The importance of forests is further borne out through the treatment it receives in Kautilya's *Arthashastra*. After the Mauryas, the other significant empire builders were the Guptas. But throughout the Gupta times and more particularly later Gupta times economy began to collapse. There was a manifest decline in deal and cities and the use of monetary organization. Inscriptions belonging to the era indicate a trend towards realization of the economy and therefore greater pressure on land and consequently on the forest. Amidst all these growths, the forest question lost its 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 municipalities and cities. Consequently urban population also increased. All

this led to a proportionate quantitative augment in the demand for fuel wood, fruits, food, fodder etc. Demand for excellence timber for construction of boats, bridges, homes, chariots, structures, carts etc. also went up considerably. The Sultanate rulers did not approach out with a positive policy of conservation though of course we see gardens being set up. On the whole, though, 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 extremely 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 augment in population and urbanisation. Just as to W.H. Moreland, Indian population at the death of Akbar in 1605 AD was 100 million while R.K. Mukherjee provides the figure of 130 million for the similar years (1605AD). Jointly with the augment in common population, there was also a qualitative and quantitative growth of urban method of life. Therefore added to the existing demand of food, fuel, fodder, there was a demand for timber particularly the superior diversity. 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 shaped an significant component of the non-agrarian manufacture throughout the Mughal era.

The Colonial Era

The colonial era saw a qualitative shift in the man-forest connection 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 use begins to determine the man-forest connection (The East India Company and later the Viceroy represented the interests of colonial forces). For the first time, the proceeds of forest use 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 jointly with development in the field of transport and communication, colonial trading practices and industrial revolution brought in relation to the substantial change in this connection. Forests now came to be seen as possessions to cater to the necessities of the expanding colonial political economy.

Indian teak featured as the permanent source of supply of durable timber for the British ship structure industry. It saved England throughout 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 measured 'as an obstruction to agriculture and consequently a bar to prosperity of the Empire'. To enhance the agrarian revenues, farming had to be extended; to extend farming forests had to be removed. This procedure 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 necessities of the railways. The fuel wood necessities of the railways in the North West Provinces in the 1880 have 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 necessities, as has rightly been pointed out through several scholars, shaped 'the first and through distant for the mainly 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 power and sphere of action.

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 discover markets for the multiple species of India's tropical forests. Table 6. 1 shows the surplus generated on the revenues from the sale of forest products.

Table 6.1 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

Urban centers required forest products for fuel wood, furnitures, structure timber etc. The Himalayan forests provided bamboo, sal and many species of conifer for the urban centers of Punjab and the United Provinces and for the military cantonments and hill stations. Separately from the teak export deal, deal 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 diversity of industrial applications and foreign deal in such items showed a steady rise.

The huge importance of the forests reflected itself in other ways particularly throughout the two war eras. Throughout 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 6. 2 provides an thought of the relative importance of the forests throughout the two wars.

Table 6.2 India's Forest 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

Any discussion on the colonial impact on the forest cannot be complete without mentioning one of its mainly obvious manifestations; the decimation of wildlife. From the middle of nineteenth century, a large-scale slaughter of animals was started through the British. Much of this shooting was motivated through the desire for big 'bags'. Several Indian princes also sought to emulate the shikar exploits of the British, Another related transformation throughout the colonial era was the deviation of forest lands for the development of tea, coffee and rubber plantations. In information the state's desire to commercialize 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 procedure of deforestation. Besides, the plantation economy itself had a high stage of timber demand for fuel and packaging. The colonial state has been criticized on several other accounts as well.

For decline in traditional methods of forest conservation, promotion of single species teak monoculture, socio-economic and cultural marginalization of tribals and other forest dwellers – all went a extensive method in bringing in

an element of incongruity flanked by forest ‘preservation’ and human subsistence.

Post-Independence Era

Throughout the post independence era big tracts of forestland sustained to be diverted to non-forest purposes in the name of ‘development’. Although this theme has been discussed in several accounts on forests, we shall only seek to familiarize ourselves with the nature of the problem. The phenomenal growth of population and urbanisation and the consequent extension of agriculture, construction behaviors, rising industrial proliferation, mining and quarrying behaviors all took a huge toll on the forested regions. With the development of a big 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 lay at the cost of neighboring forests. The politics of refugee rehabilitation also affected forest covers in several regions. The mushrooming of criminal gang’s smugglers and timber mafia jointly with the rising prices of timber has led to a ruthless denudation of forestland. In addition, forests have of late, also becomes a haven of several terrorist and insurgent groups. Several forests, in the North East, Jammu and Kashmir, the Terai, Andhra Pradesh have suffered due to these behaviors. Some of the conventional factors like forest-fires, in excess of grazing, shifting farming, careless use of construction timber have had a devastating effect on forest acreage. Besides these sure other factors, neglected on explanation of playing a relatively little role in degradation of forest cover, have also to be taken into explanation. These contain industrial emissions, air pollution and harmful effects of plant parasites, insects, fungi and wild animals. Table 6. 3 provides us a relative thought of diversion of forestlands for non-forest uses.

Table 6.3 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

Just as to some estimates, India is steadily losing in relation to the 15 lakh ha of good forestland annually. The number of trees that are felled annually could be approximately equal to country's consumption of oil, coal and electricity put jointly. Just as to the State of Forest Statement, 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 era 1991- 93, the total forest cover of the country is 639.600 sq. km., which is only 19.45% of the total geographical region of the country. Non-government estimate though differ on the question of the extent of the forest cover in the country and provide a figure below eve 19%. Clearly forests have suffered even after independence was achieved.

Recent Debates

Madhav Gadgil and Ramchandra Guha, in *This Fissured Land: An Ecological History of India,* Delhi, 1992 lay down the vital premises of the recent debate. Through portraying a rather romanticized notion of man forest connection, the authors say that despite the grave inequalities of caste and class, the pre-colonial Indian Civilization had a considerable degree of coherence and stability. This permitted a rapid turnover of ruling dynasties

without major upheavals at the stage of the village. The cultural traditions of prudence ensured the extensive-term viability of manufacture and of the institution of caste, which was its central underpinning. Elaborating their argument, the authors take the location that in pre-colonial India, resource utilization was in harmony with nature and resource sharing in the middle of several strata of the civilization was extremely cordial. The dissimilar claims of dissimilar possessions in the caste organization 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 through a scrupulous economic action and a scrupulous ecological niche. The analysis of the several environmental movements have been explained in conditions of disruption caused through 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 through British It is argued that it was the 'colonial power' that initiated systematic forest conservation policy in colonies. *Nature and The Orient*, problematical the situation saying that it is an open question, though, 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 farming. It is asserted that the proof from other British colonies that urbanized forest departments at much later dates suggests that, without exclusionist forest reserve legislation, mainly surviving shapes of 'general property management' would have faded absent.

There appears to be a feeling that indigenous people were more responsible for the situation therefore either they should have been trained to contemporary knowledge or prohibited from those regions. Ravi S. Rajan argues that the concerns for greater revenue appropriation (agricultural manufacture) and the rising demand for wood led to 'disagreement of interests'. Attempts were therefore made to attain a balance flanked by agriculture and forests; some lands were recognized as suited for agricultural purposes while the marginal lands were to be urbanized as forests. The

primacy of agriculture was therefore quite apparent. Antagonism flanked by forest and agriculture was not easy as forest were measured necessary for good rains and at the similar time it was whispered 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 crossways India and recent researches have pointed out that there were serious divergences of views on policies related with the forest/ land/agriculture. Sivaramakrishnan tries to locate the debate in the context of the formulation of the Private Forest Bill in Bengal flanked by 1865 and 1878. He tries to explore conflicting interest's vis-à-vis natural possessions. There were many claimants and the state had to consider many probabilities before arriving at any formal policy It was not only scientific knowledge (deforestation and desiccation) which contributed in the debate but several self interests also tried to appropriate the issue and mend the policy in one's favor. The underplay of several socio-economic interests and environmental concerns made the whole debate so intricate that ultimately the bill could not be formatted.

The major issue involved in this debate was the property rights sanctioned through permanent resolution. These forests were often termed as *Jungle Mahal*, hence accepted as private property. Any effort to withdraw or curtail the similar would lead to greater resentment. This was the era 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 resolution' British expected that marginal lands would also be put to better positive use as landlords will attempt to maximize the agricultural manufacture on better lands and marginal lands shall be utilised for forests. Though, it was not the case in eastern India, and later on, with the rising 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* in excess of the forest produces

(which they argued were recognized through custom) 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 use was significant 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 apparent heterogeneous views. He tries to explain the issue with respect to soil erosion and shifting farming through 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 sylvi-culture with the help of shifting farming and abandoning farming as such. Examples from West Africa were cited to point out the benefits of shifting farming, but it was put aside through citing the nature of forests in India. The other related issue was the tussle flanked by the foresters and scientific advisors. 'The political damage caused through shifting farming was its inducing itinerant habits on parts of the local population, discouraging agricultural progress and facilitating the evasion of taxes'. The problem caused through shifting farming was not only of tax evasion but the superior issue of timber deal\ supply to cater to the requires of British.

The problem of soil erosion on the one hand was caused through the cutting of forests for commercial use and on the other due to clearing of land for agricultural purposes. It was further fuelled through the ever-rising 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 technological intervention was through no means value neutral'. Another region of exploration has been the analysis of the several policies having a bearing on the environmental issues. Vasant Saberwal argues for the rising recognition within the academic ecological society of the complexities of ecosystem functioning and the limits to our

predictive and explanatory capabilities with regard to big-level ecological phenomenon. His explanation brings it out that the concerns for conservation evolved in excess of a extensive era of time beside with the growth in the scientific knowledge in relation to the environment. The require to look at the role of state in appropriation of scientific knowledge in support of its claims has been pointed out.

Ajai Skaria highlights the common negligence of marginal regions and laments the importance of traditional issues. He tries to locate the troubles of marginal issues in the context of politics of growth. The similar is extremely significant for the construction of thoughts such as jangali/tribal/primitive. Skaria questions the notion whereby tribals were equated with 'wild' and 'primitive' and settled agriculture with civilization. 'What the British did not realize 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 described not for retaliation but for a renegotiation of shared Sovereignty'. He also explores the several procedures of mutual dependence flanked by state and tribal polities. Revenue rights and power were shared in a intricate web of connection where weakness of the either face was visible in the conditions of resource sharing.

Forest Policies: A Politico-legal Analysis

From a rich source of forest wealth in the pre-independence era, India has been reduced today to a location of minimal forest cover. Reckless use coupled with absence of a comprehensive policy has led to a huge shrinkage in forest resource. As such, the require for a national policy governing all characteristics of forest management becomes pertinent. The formulation of a 'appropriate' forest policy began in the colonial era itself. From the establishment of the forest department in 1857 to the National Forest Policy, 1988, India has approach a extensive method trying to cope with the problem of declining forest cover.

The Colonial Background

Any discussion of the forest question in self-governing India cannot be complete without a account of colonial forest policies. Motivated ostensibly through exploitative causes, 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 civilization like India, agriculture and forests had to bear the brunt of the burden.

In order to rationalize their unbridled use as well as to appease the voices of opposition both within and outside the officialdom, the British took some events that were given the form of policy. Let us have a seem at the major milestones in the development of forest policies under the British rule and in self-governing India.

- ***Establishment of the Forest Department:*** Stating forest administration up to the 1857 rebellion a melancholy failure the Governor-Common of India Lord Dalhousie described 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 shaped in 1865 and Dietrich Brandis, a German botanist was appointed as the first Inspector Common 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 effort through the state to assert its monopoly. It was primarily passed to facilitate the acquisition of those forest regions that had been earmarked for the railway supplies. It merely sought to set up 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 therefore had several shortcomings. Immediately after its enactment so the search began for a more comprehensive piece of legislation. A preliminary draft prepared through Brandis was circulated for discussion. A conference of forest officers was convened in 1875 to frame a new act. Three positions cropped up throughout the deliberations on the proposed act:

- The *annexationists* wanted total state manages in excess of all forest regions.
- The *pragmatists* argued for state management of ecologically sensitive and strategically valuable forests, allowing others to remain under communal systems of management.
- The third location often described the *populist* location totally rejected all shapes of state intervention holding that tribals and peasants necessity exercise sovereign rights in excess of woodland.

The matter was finally resolved in favour of the annexationists. The concrete proposals were embodied in Brandis' memorandum of 1875, which, jointly with Baden-Powel's paper shaped the foundation of 1878 Act. The Act cleared all confusions in relation to 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:

- ***'Reserved' Forest:*** In such forests, which were compact and linked to the cities, a legal separation of rights was aimed at. A permanent resolution either extinguished all private rights or transferred them elsewhere or in exceptional circumstances allowed their limited exercise.
- ***'Protected' Forests:*** These were also controlled through the state. Here the rights were recorded but not settled. The state manage was firmly maintained through outlining detailed provisions for the reservation of a scrupulous tree species as and when they became commercially viable and for closing the forests whenever required for grazing and fuel wood collection.
- ***'Village' Forests:*** The name itself explains this category. Such forest was under the manage of the villages and were used through 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 shaped the foundation 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 livelihood in the vicinity of the forests. One extremely harsh characteristic of this policy was the information that forest preservation was placed secondary to agriculture. It said " wherever an effective demand for cultural land exists and can be supplied through forest region, the land should ordinarily be relinquished without hesitation". Besides, a fourfold classification of forests was also made:
    - Forests (mainly on hill slopes), the preservation of which is significant on physical and climatic grounds;
    - Forest, which afford a supply of valuable timbers for commercial purpose;
    - Minor forests, usually meant to meet the fuel, fodder, and timber necessities of the dependent societies;
    - Pasture lands, to cater to the requires of the local population.

Face through face the policy pronouncements, the government also tried to setup institutes to promote better utilization of forest possessions. Therefore a forest school was recognized 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 common 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 livable on timber and other forest produce. For the present

purpose let us talk about some of the foundation characteristics of the 1927 Act.

- It enhanced the powers of the state to make reserve forests, village forests and protected forests;
- Provided state regulation of the timber and non-timber forest produce;
- Prescribed penalties for the violation of the act;
- Formalized 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 through utilitarian goals. Use rather than conservation was the keynote of the colonial policy. Therefore under the garb of promoting the interests of the people and the welfare of the nation what the British actually did was a ruthless use of the forests. Extraction of timber, both quantitatively and qualitatively, was accepted out mercilessly. Expansion of agriculture at the cost of forest cover was a blatant device to maximize revenue for the expanding empire. Further, the policies promulgated through them had many 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 effort was made to manage or regulate the forests of the native states and the *zamindars*. Wildlife protection was never significant for them. Forestry research and education though, was one aspect, which was taken up through the state but no follow up action was taken. It was never followed as a extensive-term positive policy resulting in an augment 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.

Self-governing India

India inherited the colonial forest policy (1894) and the Indian Forest Act (1927). Though circumstances had changed through then and the spatial

and temporal context of the old legislations had been altered. Population had increased considerably and so had the attendant demands of fuel, food, fodder, timber etc. Urbanisation and industrial development had also increased as had the defense necessities. Added to this was the rising realization of forest as essential to the physical and climatic balance of a country. This assumed scrupulous importance in the context of two factors; firstly rapid deforestation throughout the two would wars through the colonial state and secondly the reckless use of private forest through native sates and *zamindars* throughout the last years of British rule. The situation described for a change in approach. Forests had to be brought in the realm of planned economic development. It was admitted through the planners that per capital forest region and per capita consumption of ground wood, pulp etc. was poor. A require so was felt for an augment in overall coverage and even local sharing of forest. A change in approach was what was required. A chronological explanation of the efforts made in this direction follows.

- ***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 several 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.
- ***National Forest Policy 1952:*** The preamble of the National Forest Policy 1952 spelt out six supreme requires for the formulation of the policy.
    - Balanced and complementary land use;
    - Checking denudation in the mountainous regions, erosion beside big rivers and invasion of the sea-lands on the coastal tracts;
    - Balanced physical and climatic circumstances;
    - Supply of progressively rising demands of grazing, firewood, little wood for agricultural implements;

- Timber and other forest products for the necessities of defense, communication and the industry; and
- Maximization of annual revenue in perpetuity constant with the fulfillment of the six vital requires.

Let us now look at some of the tenets of the National Forest Policy of 1952.

- 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.

- The policy also observed that the villagers residing in the vicinity of forests should be permitted to use minor forest products in a restricted method.
- There was to be no diversion of forestland for agricultural purpose anywhere in the country. This was a major departure from the colonial policy.
- The require for controlling sand dunes in Rajasthan was accentuated as was checking of erosion and denudation beside susceptible regions.
- The policy also expressed the desirability to expand forest/ tree cover on lands owned through government and public as well as through private organizations.
- The policy also advocated that 1/3 of the geographical region of the country should have forest cover and further suggested that mountainous region which was more prone to erosion and denudation should have 60% region under forests whereas the plains can have 20% forested region.

- Described for a sustained supply of raw materials for forest-based industries and other associated enterprises like transport and defense. The importance of research arrangement in several branches of forestry and interaction flanked by research organizations and industries was to be encouraged.
- Expressed the require to manage private forests as well as to check grazing and shifting farming.
- 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.
- Proper attention was to be paid to the preservation of unusual fauna like lion' one horned rhino etc. As such sanctuaries and national parks were to be setup.
- National Forest Policy, 1988: The inadequacies and shortcomings of the 1952 policy coupled with the realization that it had been unable to address the multifarious issues of self-governing India on a extensive team foundation described 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 statement, expressed the opinion that a reappraisal of the National Forest Policy (1952) should be made through an *ad hoc* body of experts in the light of experience gained throughout the years of development plans and the research and technologies advance made in the meadows of forestry. Subsequently The National Commission on Agriculture (1976) advocated that there were two significant points on which the National Forest Policy should rest:

- Meeting the requirement of industrial wood for forest-based industries, protection, communications and other public purpose as well as fuel wood and fodder for the rural society; and

- Meeting the present and future demands for protective and recreative functions of forests.

The Commission therefore sought to adopt a middle path flanked by utilization and preservation of forest wealth. It recommended:

- A change of strategy from a more conservation oriented forestry to a more dynamic programme of *manufacture forestry*;
- The future manufacture programme was to concentrate on clear felling of valuable mixed forests, mixed excellence forest and inaccessible hardwood forests and planting these regions with appropriate fast rising species yielding higher returns per element region; and
- 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 rising trees on lands accessible to village people.

The after that 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 self-governing India. The vital 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 look at the adequacy of the existing administrative, legal and institutional arrangements for protecting environment. The committee noted that the commercial interests and the requires of the poor for essential fuel and fodder contributed to the denudation of forests and regulation. It therefore recommended the inclusion of fuel and fodder supply in the Minimum Requires Programme.

Two years later in 1982 a Forest ministers' meeting was described. Two themes were retreated at the meeting — conservation for environmental

and ecological requires and for preservation of wild life and genetic possessions 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 through prime minister and attended through chief ministers of dissimilar 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;
- Little and marginal farmers would be especially encouraged to use their degraded lands for meeting commercial necessities.

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 survival necessities of the local people. The main characteristics of the 1988 policy are:

- Maintenance of environmental stability through preservation and restoration of ecological balance;
- Conservation of natural heritage through preserving the natural forests and protecting the vast genetic possessions for the benefit of the posterity;
- Meeting the vital requires of the people, especially fuel wood, fodder and little timber for the rural and tribal people;
- Maintaining the intrinsic connection flanked by forests and the tribal and other poor people livelihood in and approximately forests through protecting their customary rights and concessions in the forests.

The implementation the policy was facilitated through the Government. of India through 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.

RESOURCE MANAGEMENT: WATER

Situating Water Possessions: Colonial Era

The proof for the use of water possessions through the earliest settled civilizations is enough to merit an analytical attention. We have seen that the practice of irrigation since the establishment of settled agriculture throughout the Indus Valley Culture was an recognized characteristic. As agricultural development was the pillar of the economy, all big powerful empires paid special attention to development of irrigation systems. Early in history, throughout the Mauryan era, a big reservoir described Sudarshana was created at the foot of mount Girnar in Saurashtra for supporting irrigation in the semi-arid circumstances of the lay. In the south, perennial irrigation may have begun with the construction of the Grand Anicut through the Cholas as early as second century AD to utilize 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 through raising dams/embankments crossways the flow channel.

The references relating to the use of water possessions in the medieval era are as plentiful as for the earlier era. Rapid advances took lay in the construction of inundation canals. Water was blocked through constructing bunds crossways streams. The Tughlaqs encouraged the digging of canals and Firuz Shah Tughlaq is measured to be the greatest canal builder before the nineteenth century. In south India too the situation was the similar. Irrigation is said to have been one of the major causes for the growth and expansion of the Vijayanagar Empire in the fifteenth century. The Mughals had recognized the importance of water as they promoted irrigation facilities through providing loans to farmers to install irrigational devices. Water is said to have played such an significant role in the life of a municipality that Delhi was abandoned and rehabilitated seven times in search of abundant water possessions. Shahjahanabad, the Mughal Capital was situated beside the riverbank keeping the factor of easily accessible water possessions in view. It may be noted that, but for exceptional cases, mainly of the canal irrigation

prior to the arrival of the British was of the diversionary nature. In the early nineteenth century, though, the colonial rule initiated a ‘sharp break’ in the technique through introducing perennial canal irrigation in many parts of the South Asian subcontinent.

The colonial interface with water possessions began with the development of irrigation works — the renovation, improvement and extension of existing network. Soon afterwards was started what is recognized as the ‘period of contemporary irrigation’. For the first time, permanent head works in the form of barrages and weirs were thrown crossways 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 through impounding water throughout lean season and diverting it into canals and, on the reverse, the former could be flipped open to release waters throughout eras of the river’s peak discharges. In effect, through flattening the river’s variable flow regime at sure points beside its course, irrigation was sought to be transformed from a seasonal to a perennial possibility. The ensuing era saw the construction of many big 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 era – the Triple Canal Project (1916).

The recurrence of drought and famines throughout 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 measured likely to meet the productivity test, they had to be financed from current revenues. Important protective works constructed throughout the era incorporated 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 through the famine and irrigation commissions. The First Famine Commission (1880) accentuated the require for direct state initiative in the development of irrigational works while the First Irrigation Commission (1901) recommended the renovation of many existing defunct or dilapidated irrigation works while proposing new schemes. It drew up a 20-year plan envisaging a vast public

expenditure to irrigate 2.6 million hectares of meadows. 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. Recognized as the Multi-Purpose River valley Development (MPRVD), the new model of water resource development was sculpted on the rows of the Tennessee Valley Association (TVA) in the post-depression United States. The new technique envisaged focusing upon the whole 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 method to its estuary through 'harnessing' its waters simultaneously for navigation, irrigation, flood manage, and power generation. Flanked by 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 sustained to remain the dominant strategy of water resource management in self-governing India. Multi-Purpose river projects looked the best solution as India occupied in planned economic behaviors to achieve self-reliance, foster economic development and improve the average of livelihood of its people. Some significant projects were initiated such as the Damodar Valley Project. Completed in 1963 crossways the Sutlej River, Bhakra-Nangal Project was the joint venture of Punjab, Haryana and Rajasthan governments; built crossways the river Rihand (a tributary of Son River), the main 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 crossways 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 flanked by the governments of Bihar (India) and Nepal in 1954. Its main objective was to construct a barrage close to Hanuman Nagar in Nepal beside 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 similar kind. The harness of water possessions on a big level had become the priority of the state policy.

The Contested Domain: State, Environment and Water Possessions

The themes of water, society, state and environment form an integral part of the modern 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 form questions approximately water possessions and their development in India. Both narratives invoke polarized notions of state and the society and both emphasize and discover justification in the subsistence of extensive-term, successful, indigenous society supervised irrigation systems, conceptualized as a counterpart to resource management through the state. The first is the critique of the modernizing development strategies of the centralized state and the dominance of western technological perspectives on the irrigation and water possessions in excess of those of the indigenous society; a critique sharply focused in recent years through the controversy in excess of big dams, the Sardar Sarovar in scrupulous, 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 society of users, which shapes a part of the international consensus on public sector reform underpinned through ideologies of privatization, free state, and a reduced role for the development state.

The connection flanked by state and resource management has often been explained in conditions of a linear grand or mega narrative. The dominant thrust of such overarching explanation recognized as a ‘average environmental narrative’ or ‘new-traditionalist’ discourse puts all the blame on the state. Just as to such narratives, the pre-colonial India is seen as a era 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 general possessions leading to the demise of village

traditions of sustainable resource use. The procedure was accelerated through the post-colonial shapes of government. The dichotomies of society/state, pre-colonial/ colonial, custom/modernity, and indigenous/foreign are very polarized in the traditional narratives.

In their search for a grand causal theory, the environmental protagonists of water possessions extend the 'average environmental narrative' to highlight what they consider as the breaking point in traditional water management systems. Modeled on the rows of Mahatma Gandhi's environmentalism, the classic argument comes from the authors of *Dying Wisdom*. 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 possessions and economic and political affairs. With the rise of the state manage in excess of general water possessions, there was an 'erosion of the autonomous functioning of village management systems'. Colonial rule converted village general property into state property, denied customary rights and weakened traditional village power transforming supervised commons into degraded free access possessions; it placed the decentralized village water systems under the manage of centralized bureaucracies which prioritized contemporary 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 self-governing India with big dams as temples to Gandhi's vision of self-governing India founded upon its village heritage. It also calls for the revival of society manage and traditional water harvesting systems. There is so a require 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 society.

The relationships flanked by the state and the society were more intricate and problematic than has been made out to be in traditional accounts. David Mosse points out in his revise of statecraft, ecology and communal action in South India that the impact of colonial governance on the water commons defies a easy representation and has more to do with changing systems of state than the erosion of village custom. Indeed, traditional village water management organization proves very elusive, and identification of the moment of their collapse is an impossible task involving a seemingly endless journey back in the time. Therefore the decisive moment of a loss can be variously situated in:

- The present government's neglect of indigenous knowledge and traditions;
- The 1960s-70s green revolution expansion of capitalist agriculture and ground water irrigation;
- Changes brought in relation to the in the 1950s following Independence (for instance, the abolition of Zamindari estate and establishment of structures of local government);
- The colonial commercialization of arid land agriculture in the late 19th and 20th centuries;
- The centralization of the colonial government and the structure of technocratic irrigation bureaucracy from the 1850s;
- The consolidation of British power, its revenue systems and property law through the 1840s;
- The dismantling of the south Indian old regimes approximately 1800;
- The wars of the immediate pre-colonial era of the 1790s;
- The neglect of decentralized systems under the Mughal rule throughout the 18th century;
- The disruption generated through the rise of the Vijayanagar empire in south India after 1350; and
- The collapse of the Chola empire and its organization of locality and village government.

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. Just as to the National water Policy, 2002 as per the latest estimate (1993), out of a total precipitation (including snowfall) of approximately 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 several constraints of topography and uneven sharing of resource in excess of legroom and time, it has been estimated that of 1869 cu.km., only in relation to the 1122 cu.km. can be put to beneficial use. From this almost 690 cu. km. shall be due to surface water possessions. The availability of water is highly uneven in time and legroom. Precipitation is confined only to monsoon months every year varying from 100 mm in Rajasthan to in excess of 10000 mm at Cherrapunji in Meghalaya. Rivers and underground water aquifers often cut crossways state boundaries. Based on 199l Census, the per capita availability of water works out to 220 cu.m (See table 6.4).

There are two main sources of water possessions: surface water and ground water. Rivers are main source of surface water; the following chart makes clear the potential of surface water:

Table 6.4 Basin-Wise 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

Inland water possessions 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 accepted through the rivers of the country is in relation to the 16,45,000 million cu.m. Of the rivers and canals, Uttar Pradesh occupies the first lay with the total length of 31.2 thousand km, followed through Jammu & Kashmir and Madhya Pradesh. The after that in the order of geographical coverage of inland water bodies are the tanks and ponds occupying 2.9 m.ha. and then approach the reservoirs covering 2.1 m.ha. Mainly of the region under tanks and ponds lies in southern states of Andhra Pradesh, Karnataka and Tamil Nadu. Beside with West Bengal, Rajasthan and Uttar Pradesh, these states explanation for 62 per cent of total region under tanks and ponds in the country. As distant as reservoirs are concerned, major states like Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Uttar Pradesh explanation for a superior portion of region under reservoirs. More than 77 per cent of region 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 through Gujarat, Kerala and West Bengal.

The importance of groundwater as a source for meeting drinking, industrial and irrigation necessities for an ever-rising population cannot be denied. It caters to approximately 50 per cent of the total irrigation in the country. India has a vast region for ground water possessions. Approximately 22 per cent of India's rainfall percolates under the ground. Of this total, in relation to the 430 billion cu.m reaches up to the upper surface of the soil. Almost 384 billion cu.m reaches the pervious strata, which can be obtained through digging wells. Just as to a rough estimate the total ground water reserve at a depth of 300 m is 3700 m ham. This is approximately 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 conditions of use of ground water potential Punjab comes on the top (93.85 per cent), followed through 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 (See Table 6.5).

Table 6.5 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

Although the ground water is a resource that can be replenished annually, its availability is non-uniform in legroom and time. A wide range of factors; climatic circumstances, relief (topography), geological structure and local hydrological circumstances manage the ground water occurrence and movement. No precise techniques are available for assessment of recharge and discharge so the methods employed for ground water resource estimation are all indirect. Ground water being a dynamic and replenish able resource is usually estimated based on the component of annual recharge, which could be urbanized through means of appropriate ground water structures. An understanding of the behaviour and features of the water bearing rock formation recognized as aquifer is crucial for the quantification of ground water possessions. An aquifer has two main functions:

- To transit water (conduit function) and

- To store it (storage function).

The ground water possessions in unconfined aquifers can be classified as static and dynamic. The static possessions can be defined as the amount of ground water available in the permeable portion of the aquifer below the zone of water stage fluctuation. The dynamic possessions can be defined as the amount of ground water available in the zone of water stage fluctuation. The replenish able ground water resource is essentially a dynamic resource, which is replenished annually or periodically through precipitation, irrigation return flow, canal seepage, tank seepage, influent seepage, etc. The methodologies adopted for computing ground water possessions, are usually based on the hydrological budget techniques. The hydrologic equation for ground water regime is a specialized 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 troubles associated with the unscientific and unregulated development of groundwater are the in excess of-use of the resource leading to a fall in water stages 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 locations 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 regions of Tamil Nadu and Saurashtra region.

For an effective water security organization, it is imperative to take steps for augmentation of ground water storage through artificial recharge concurrent with the events for development of the resource. The CWGB has accepted 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 events. These studies mannered in Gujarat, Maharashtra and Tamil Nadu have recognized the feasibility of several recharge events 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 establish to be particularly effective in checking the surface runoff throughout the monsoons and conserving the similar water recharging the underlying aquifers. Pilot projects have been accepted out through CWGB in Karnataka, Maharashtra, Delhi and Chandigarh in this regard. Efforts have also been made to intercept and recharge the rooftop runoff throughout the rainy season through encouraging the installation of easy water harvesting systems.

There is though a require for appropriate legislation to manage and regulate several characteristics related to the utilization and development of ground water. The Ministry of Water Possessions, Government of India has prepared a model bill in this regard. Recognized as the Model Bill to Regulate and Manage the Development and Management of Ground Water, its provisions contain the establishment of a ground water power, powers to notify regions to regulate and manage the development and management of ground water, grant of permits, registration of users, penalties for offences, efforts at promoting rain water harvesting etc.

Water-Possessions: Spatial and Temporal Variations

- Rajasthan, which accounts for approximately 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 flanked by 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.
- In relation to the 80 to 90 per cent of the annual rainfall occurs throughout the four monsoon months (June to September) every year. For six to eight months of the year, the rainfall is either scanty or nil in excess of mainly parts of the country.
- Rainfall in India shows unequal geographical sharing and the frequent departures from the normal. It usually exceeds 1000 mm in regions to the East of Longitude 78 degree E to 2500 mm beside approximately

the whole West Coast and Western Ghats and in excess of mainly of Assam and sub-Himalayan West Bengal. On the west of the row 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 big regions of rainfall less than 600 mm with pockets of even 500 mm.

- Of the major rivers, the Ganga – Brahmaputra - Meghana organization is the major organization with a catchment region measuring almost 110 m.ha, which is more than 43 per cent of the catchment region of all the major rivers in the country. The other major rivers with catchment region 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 region of inland water possessions is unevenly distributed in excess of 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.

Current Issues

The water resource management in India is today faced with some significant issues. We necessity address them in order to understand the underlying conceptual operatives and also to discover a method out from the impending impasse that threatens to make water possessions the mainly contested and bitterly disputed matter. A list of such issues may be shaped as below:

- Inter-State Water Disputes
- Inter-Linking Rivers: The National Water Grid
- Big Dams versus Little Dams
- Flood Manage versus Flood Management
- Water Pollution

Inter-State Water Disputes

Mainly 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, sharing or manage of the waters in respect of several inter-state rivers or river valleys or in the interpretation and implementation of the conditions of any agreement relating to the use, sharing or manage of such waters or in the levy of any water rate in contravention of several prohibitions. Throughout the British era, inter-state disputes were settled through the central government. Upon adopting a constitution the Republic of India made irrigation a state subject. The state governments could now exercise manages in excess of scheduling, development, regulation, and sharing of water flowing through their territories. In excess of a era of time sure legislations have been enacted which enable the central government to intervene in matters of inter-state dispute. Just as to the Water Dispute Act, 1956, the central government can constitute a tribunal for the resolution 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 shaped rules on 30 June, 1959 to settle inter-state water disputes. Through 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 manage of the Union is declared through the Parliament through law to be expedient in the public interest. Under Article 262 of the Constitution, the Parliament is empowered to give for the adjudication or manage of the water of any inter-state river. The following chart provides a preliminary thought 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 distant, 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. Mainly of the inter-state water disputes have been settled on the foundation of equitable apportionment, which is the universally accepted principle. In addition, India also has some disputes with neighbouring countries like Nepal, Bangladesh, China in excess of sharing of river waters.

Inter-Linking Rivers: The National Water Grid

It was in the middle of the nineteenth century that schemes for linking the rivers of whole Indian sub-continent were first planned. Since then approximately a century passed before a alike thought was proposed again. In 1960s, K.L.Rao the Union Minister of State for Power and Irrigation spoke in relation to the Ganga-Cauvery Link Canal. Later in the seventies, he urbanized 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 extensive. In the meantime Captain Dastur had proposed a alike thought. Popularly recognized as the 'Garland Canal', the project envisaged a 4200 km extensive 300 m wide Himalayan Canal aligned beside the southern slopes of the mountain range and another 9300 km Central and Southern Garland Canal. Both these canals were to be connected at Delhi and Patna. In 1982, the Government of India shaped 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 recognized 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 whole 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 several 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 technological 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. Just as to the internationally accepted definitions, eight of the twenty basins of India are water-scarce today and through 2025 (when the water grid is expected to be fully functional) thirteen river basins will be below the water-scarcity stage. It is also argued that all the basins will qualify as water stressed, with the exception of Brahmaputra- Barak organization.
- Where would the funds for the plan approach 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 approach. All in excess of the world, inter-basin transfers have proved to be the mainly expensive option to develop water after that only to seawater desalinization. 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 explanation. It has been argued through hydrologists and ecologists that as opposed to being merely moving masses of water out to be regulated and dammed, rivers are fluvial regimes with intricate geomorphologic, chemical and biological procedures in motion. They are made up of a wide diversity of aquatic and riparian species. Rivers with highly altered and regulated flows lose their skill to support natural procedures. Experience from the U.S. (California), Israel, and former Soviet Union designates 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 through Orissa and Andhra Pradesh. Separately from the techno-economic feasibility, on which the Ganga- Cauvery link thought 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 extremely kindly.

The following chart illustrates some of the promises and pitfalls of the planned interbasin 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

It has been suggested that the feasibility of inter-basin transfers should be examined for contiguous basins, on a case-through-case foundation 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. Society 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. Alike district and watershed-stage experiences from Maharashtra, Madhya Pradesh and Andhra Pradesh hint at the potential possibilities of society based and participatory water management.

Big Dams versus Little Dams

India has approximately 4300 dams of which 2256 were built in a peak era flanked by 1971 and 1990. Approximately three-quarters of the completed dams are situated in three western agricultural states. The big dams in India are constructed and owned through state governments. Though droughts in recent years have raised some extremely vital questions concerning big dams. The supporters of big dam projects argue that:

- Dams confer several benefits and without them, the rising requires 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 sure 'political economy' factors prevalent in the country; and

- Little dams, local watershed development, and water harvesting etc. are no substitute for big dams- they are complimentary events that can meet only a little part of the overall necessities.

On the other hand, those who question the acceptability of such claims contend:

- Benefits, supposedly coming from several dams are overstated and the cost understated;
- Impact and consequences are rarely assessed in advance and cannot be fully foreseen, much less remedied; several adverse effects are irremediable;
- Requires of the future can be met without recourse to big dams, through smaller structures and demand face management.

The central question is whether the price of environmental damage and social disruption of indigenous and other societies is worth the ostensible benefits of providing water and power. The debate has become increasingly heated and has assumed the form of a broader disagreement flanked by top-down, technocratic, and interventionist approaches to development and bottom-up, participatory and in the vicinity appropriate alternatives. The debate in India has been exemplified through a number of protest movements against big dams, the mainly well recognized being the Narmada Bachao Andolan. The nature of the disagreement is even reflected in Government of India's rejection of the statement on the World Commission on Dams (WCD) on the grounds that it was incompatible with country's development priorities. While acknowledging the information that the dams have made a big contribution to human development, the WCD statement indicated that the similar had been accompanied in several cases through unacceptable social and environmental costs. In the last few years there has been an intense debate in India in excess of alternative manners of storage (like tanks, little and medium sized dams) and in-situ capture through integrated watershed development and rainwater harvesting. The procedure has received a boost through numerous case studies of successful revitalization of traditional

communal water management systems and local stage participatory management systems involving society mobilization.

Flood Manage versus Flood Management

Even after adding 16,199 kms of new embankments throughout 1954-1993 and spending crores of rupees on flood detention reservoirs, the region liable to floods in India has actually shown an augment. From roughly 19 million hectares in 1953, the flood prone region increased to 40 million- 60 million hectares based on the dissimilar estimates. The trend has so been upwards. The expenditure on flood manage has also been on the rise in the post-independence era from Rs. 13.21 crores in the First Plan to a high of 1691.68 crores in the Eighth Plan. India in information remnants the mainly flood-affected country in the world after Bangladesh. The huge 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 mainly basins thereby exacerbating the flood situation. The easy question that follows relates to 50 years of embankments and big 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 manage to flood management and its application in the Indian context.. It has been argued that recovering the experiences of flood utilization would be an significant component for forging a more viable response to the flood situation in the extensive run.

Water Pollution

Just as to Centre for Science and Environment, Delhi, 25 big cities and municipalities beside Ganges discharge secure to 1340 million liters per day of sewage mostly untreated waste including traces of heavy metals in the river. Agricultural runoff, mainly fertilizers and pesticides, also discover their method through the drains and tributaries. Likewise from the time Yamuna enters Delhi at Wazirabad it is loaded with secure to 1700 million liters per day of untreated sewage. In the south, the Noyyal tributary, which flows into

the Kaveri River, has in excess of 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 through pollution. In excess of-pumping in some coastal regions 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. Just as to one such estimate, there is a 6 to 7 per cent decrease in available ground water due to sewage, wastewater and garbage.

REVIEW QUESTIONS

- How did industrialism shape the colonial perception of environment? Discuss.
- Did colonisation of India result in environmental degradation? Comment.
- Discuss the agenda of the English colonial power with regard to the forest resources of India.
- Write an essay on the forest resources and their management in Colonial India.
- Write an essay on the importance of water as a natural resource.

CHAPTER 7

Modern Concerns

STRUCTURE

- Learning objectives
- Development and environmental concerns
- Biodiversity
- Environmental resources and patents
- Alternatives
- Review questions

LEARNING OBJECTIVES

After reading this chapter you should be able to:

- Understanding development and environmental concerns.
- Explain the deep and social ecology
- Describe the biodiversity and its meaning and importance.
- Understand the India's biodiversity.
- Understand trade related aspects of intellectual property rights.
- Explain the environmental conservation.

DEVELOPMENT AND ENVIRONMENTAL CONCERNS

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 idea and practice in both socio-economic and intellectual domains. Partha Chatterjee argues that anti-colonial nationalism in Asia and Africa in common and India in scrupulous 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 cautiously studied and replicated…'.

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 jointly created a corpus of scientific (natural and social) knowledge and scientific apparatus 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 industrialized economy, supported through democratic state (universal adult franchise) and modernized civilization (equality flanked by citizens) geared to serve the goal of continuous macro-economic growth synonymous with development.

Evidently universal average 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 through displacing traditional agricultural action. Though this model gave a scrupulous awareness of backwardness and therefore made it lopsided, the 'universal standards' themselves and the means to achieve them were never measured fundamentally flawed. Further, the political economy discourses within Liberal Democracy and Marxism, the two major paradigms, also showed that there was no disagreement flanked by them as

distant as the understanding of the means to achieve economic growth/development was concerned.

This discursive unity reflected a singularity of purpose concerning the strategies and development programmes that were intended from a presupposed objective. The vision of development enshrined in the mainstream school of idea gave rise to the following: Promoting the replication of history of the western civilizations in the countries of South. This allowed to it the luxury of considering history of development as unilinear, apolitical and technology-driven, self-governing of specific socio-political and cultural factors.

Reflecting an 'elitist and deterministic' view as distant as sharing of economic growth and consequent social dealings were concerned, i.e. it assumed that the whole civilization, irrespective of varying social sites within, would job towards the end objective of development. Hence, energy of the dominant categories as well as 'backward and gendered mass' was to be canalized in this scrupulous direction. It was premised, in the languages of Partha Chatterjee, on "one rational consciousness and one will – that of the whole. Scrupulous interests needed to be subsumed within the whole and made constant with the common interest" for the benefit of the whole.

- The liberty of considering a scrupulous part of the people weaker and the other part enlightened. Hence, allowing the latter to chart out a course of progress for the former from their standpoint.
- Ignoring the agency of the subordinate part of the civilization in the procedure of development and creation those mere instruments in achieving the end objectives defined on their behalf through the dominant social categories. This also disallowed the general people from being in charge of evaluating and controlling the path of development. This made the development prone to manage of experts and highly centralized in its approach.
- Envisaging a pattern of economic growth (hence development) that would never take into explanation the limits to the use of environmental resources. This would promote energy rigorous and

unsustainable industrialization and a reckless intervention in the systems of nature.

This model of development has been severely criticized both from within as well as outside the environment and development policy establishment. The response to these criticisms came from organizations as well as self-governing writers, policy analysts and activists.

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 Statement (WCED), popularly recognized as Brundtland Statement. This statement 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. The statement and the subsequent conference have shaped the theory and practice of environment and development in the past decade. The WCED Statement discusses four significant factors, which contribute to a present day crisis in matters relating to environment. These are: poverty, growth, survival, and economic crisis.

The cause of poverty is traced to many national and international factors. International factors contain disadvantageous conditions of technological transfer, protectionism, and inadequate financial flow. At the National stage poverty is the result of unequal sharing of land and other assets, rising population, and commercialization of natural resources (*Ibid*). The Statement further points out that economic growth increases total amount of resource use while at the similar time also results in increased human intervention in natural cycles besides emphasizing on energy rigorous growth. While discussing survival the Statement points out the vulnerability of human survival due to threats like green home gases, radioactivity, toxic wastes etc. Finally, the Statement 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 problem, just as to Statement, is "fragmented nature of organizations and policies" which is not able to integrate manufacture with "resource conservation and enhancement". Hence, the Statement advocates, "sustainable development" (which meets the require of the present generation without compromising with the skill 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 excellence of growth" (less energy rigorous) in order to meet the essential human requires In the realm of natural resource management, it promotes effective decentralization 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".

Likewise Agenda 21 points out the necessity of achieving sustainable development at every stage of civilization. People's organisation, women's group and non-governmental organisations are recognized as significant source of innovation and action at the local stage having a strong interest and proven skill to promote sustainable livelihood. It further asserts that governments in cooperation with Non-Government Organisations (NGOs) should support a society-driven approach to sustainability, which can provide societies a big measure of participation in sustainable management and protection of the local natural resources in order to enhance their productive capability. It stresses on the necessity to take special events to empower women through full participation in decision creation, and of promoting sharing of experience and knowledge flanked by societies.

This Conference triggered a lively debate on the concept of sustainable development which had become a buzzword and was used through authors and critics belonging to all schools of idea approximately 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 information that the top priority accorded through 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 similar, i.e., rapid industrialization with modernization. The assumption again remained the similar, that the benefits of growth would trickle down and produce a same 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.

This model of growth is a shift from the earlier model of mixed economy (as distant as India is concerned) only to an extent that State's role in administration and allocation of resources in several sectors of the economy has to be substituted through the market mechanism with the corollary of minimizing 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 emphasizes commercialized and export oriented agriculture economy. Even in the food grain sector, the target, and accordingly, the policies, is intended to meet the food security of the country rather than the food security at the household stage, especially of the marginalized social categories.

The WECD statement and subsequent other reports give an insightful diagnosis of the interconnected environment-development crisis. It is clearly recognized through all the reports that there is a secure linkage flanked by poverty and unsustainable use of resources, but when it comes to solutions it does not go much beyond conventional thoughts and methods. Moreover as we see the development at the stage of praxis we do not discover it to be a satisfactory experience. A statement prepared through United Nations after the completion of five years of UNCED points out: "Although economic growth – reinforced through globalization –has allowed some countries to reduce the proportion of people in poverty, for others marginalization have increased. Too several have seen economic condition worsen and public services deteriorate; the total number of people in the world livelihood in poverty has increased. Income inequalities have increased in the middle of countries and

also within them, unemployment has worsened in several countries, and the gap flanked by the least urbanized countries and other countries has grown rapidly in recent years. …the state of global environment has sustained to deteriorate and important environmental troubles remain deeply embedded in the socio-economic fabric of countries in all regions".

The subsequent reports which have approach from United Nations and its associated organs are also well researched. But it is motivating to note that researchers, critics, analyst from several schools of idea – all vouch for the similar model of development, i.e. "decentralized", "participatory", "defined from below". They attempt 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 civilization will make a strong civil civilization, which will pressurize the governments to perform. Though historical experience designates that democracy does not always result in the growth of vibrant civil civilization.

Tornquist points that an elite led democratization as seen in Philippines resulted in "boss-rule" at the local stage and "personalized populism" at the national stage. He cites the case of India and asserts that centralized democracy there coupled with liberalization has resulted in populist mobilization on the foundation of religious or cultural identities. Likewise, in authoritarian regimes, privatization and deregulation has "enabled mainly of the old power- holders to reorganize their network and legalize 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.

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 background of such criticism United Nation's Development Programme (UNDP) proposed two

closely interrelated policy recommendations – *Sustainable Human Development*, and *Governance for Sustainable Livelihoods: Operational Issues*. The former is defined as a programme of development focused 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 extremely significant shift here is the recognition that economic growth measured in conditions of increased Gross Domestic Produce (GDP) does not amount to sustainable human development. 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 stage requires with the assistance of sustained mobilization of social capital through sharing or decentralization of political power to local stage constitutional as well as civil civilization organizations. UNDP defines Sustainable livelihood quite comprehensively taking both income and non-income factors into explanation: "Sustainable livelihood is the capability of people to make a livelihood and improve their excellence of life without jeopardizing the livelihood options of others, either now or in the future. Conceptually, livelihoods connote the means, behaviors, entitlements and assets through which people make a livelihood. Assets, in this scrupulous context, are defined as not only natural/biological (i.e., land, water, general-property resources, flora, fauna), but also social and political (i.e., society, family, social networks, participation, empowerment, human (i.e., knowledge, creation through 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 extensive-term foundation. Sustainability should be defined in a broad manner and implies: a) The skill 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 behaviors 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". Here social Capital is distinguished from physical, financial and human capital and refers to cultural,

political, educational attributes of a society, 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 institutionalization of such rules that have permitted such a change. Market can be a useful ally to sustainable livelihood strategy as distant as it allows the "local actors to have more power in excess of their own affairs". It is also emphasized that macro stage rule and regulation should adjust to development requires defined from below rather than vice-versa thereby giving increased emphasis to civil civilization organizations and the role of social capital in structure these institution.

It is argued that division of labour and pattern of subordination and use is so intricate in any developing country in common and India in scrupulous that any simplistic understanding of democracy results in organizations of formal democracy and not substantive democracy. The evidences, at least in theory, suggest that this paradigm of civil civilization ignores the caste class gender site and assumes citizens to be equal.

This appears to be quite a vicious circle because historical proof suggests that emergence of civil civilization is closely associated with the "rise of relatively self-governing socio-economic dealings as against the family, the feudal lord and the absolutist state". The overwhelming attendance of primordial loyalties and consequent economic dealings will never allow autonomous civil civilization to emerge and civil civilization cannot operate effectively in attendance of such social and economic connection. Further, the argument that markets make an equal opportunity for all depends on the critical assumption that initial sharing 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 basically excluded from the market. Their location becomes even more vulnerable in those civilizations where sharing of capabilities is also unequal. In such a context no amount of efforts can bring the whole society jointly in order to function in a mutually supportive manner.

Critical Discourse

Ever since environment has approach centre-stage in the discussions concerning the directions in which the developmental paradigm should be molded many views have appeared that discard the primacy of humans as the pre-eminent beneficiary of development and the consequent results of development. We have clubbed them jointly under the appellation Critical Discourse.

Deep Ecology

This school of idea rejects the human centered view of development and supports a discourse which is eco-centered. It suggests a fundamental restructuring in the principles of societal development. It promotes the ethics of conducting human affairs just as to the laws of nature. This school of idea believes that the present crisis in the realm of environment and development is due to support and promotion of ecological policies through 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 require of the time is to promote value based 'Deep Ecology'.

Deep Ecology is founded on two vital principles: one is that scientific insight into the interrelatedness of all systems of life on Earth is possible; and that the thought of *anthropocentrism* – human-centeredness – is a misguided method of seeing things. Put in other languages 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 constant with the truth in relation to the nature of life on Earth. Instead of concerning humans as something totally unique or chosen through God, they see us as integral threads in the fabric of life. Hence it demands a less aggressive human

attitude towards nature. In the languages of Naess "Livelihood a easy life, a human will effect the earth minimally: Easy in means, rich in end".
The second component of Deep Ecology is what Arne Naess calls the require for human self-realization. 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 constant with what science tells us is necessary for the well being of life on Earth.

Social Ecology

Murray Bookchin who is measured as the founder of this school of idea points out that in order to understand the present day problems ecological as well as economic and political – we necessity look at their social causes and remedy them through social methods. He writes: "basically to put civilization against nature, humanity against the bio-sphere and cause, technology and science against less urbanized, often primitive shapes of human interaction with the natural world allows us to revise 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 flanked by the privileged whites and people of colour, men and women, rich and poor, oppressor and oppressed.

Further it is pointed out "all ecological troubles are social troubles". Hence in order to understand and explain the social facts and social troubles, it is also recommended to extend the traditional boundaries of sociology beyond the interface of economy, polity, social structure and civilization through incorporating a fifth vital category of ecological infrastructure of human civilization – that is, soil, water, flora fauna, climate etc. The rationale for this is that the ecological infrastructure powerfully circumstances the development and direction of human's economic life, political dealings, social structures and ideology. Such an analysis may give a clue to the present enviro-development crisis and consequent livelihood constraints on marginalized social categories. The Social Ecologists point out that the present crisis is due to power within human civilization and power of nature through human

civilization. They support remaking of the civilization through conscious thrash about against all shapes of power – within human civilization and of nature through humans.

Eco-Socialism and Eco-Feminism

The eco-socialist provides attention to political economy aspect of environment development crisis. Marx's analysis of capitalism and his recommendation of ideal communist civilization, just as to eco-socialist, can overcome the present enviro-development crisis. There is though 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 circumstances of manufacture into explanation, its practice leads to an ecological crisis. Eco-Socialism responds to this second crisis in capitalism.

Despite differences flanked by several authors the principle eco-feminist location emanates from the understanding that the institution of patriarchy, coupled with capitalism, deprived women of their manage in excess of natural resources. These resources were appropriated for commodity manufacture and maximization of surplus value. The prescription favored through Eco-Feminism is gyno-centrism i.e. just as centrality to women, their knowledge and their manufacture and reproduction related behaviors.

BIODIVERSITY

Biodiversity: Meaning & Importance

Biodiversity is a combination of two languages – biological and diversity, meaning diversity of life shapes. It has been used extremely usually for nature and its biological wealth. Based on this understanding many definitions have also been put forward. Biodiversity is usually defined as the number and variability of all the life shapes pertaining to plants, animals and micro-organisms and the ecological intricate they inhabit. The other definition

seeks to describe biodiversity in conditions of three fundamental and hierarchically related stages of biological organisation whereby it is understood in conditions of the variability of ecosystems, species and genes. Since biodiversity refers to the whole gamut of life shapes, the connection flanked by plants and animal life as also with other livelihood organisms is also sheltered under this definition.

Biodiversity has been an significant aspect of human subsistence. "Perhaps the mainly significant value of biodiversity, particularly in a country like India, is that it meets the vital survival requires of a vast number of people. Even today there are any numbers of traditional societies which depend, wholly or partially, on the nearby natural resources for their daily requires of food shelter, clothing, household goods, medicines, fertilizers, entertainment etc." In the middle of the other benefits of biodiversity, an significant 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 so, may unleash a chain reaction where several recognized and strange life shapes would vanish altogether. The importance of bio-diversity in maintaining a food chain in itself speaks a lot in relation to the it's potential. The two documented benefits of biodiversity are:

- Consumptive and productive uses – granules, vegetables, fruits, plants, medicines, timber, oils, forest products, milk products, eggs, the list of items on this explanation 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 circumstances, 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 gives for human requires now, and is essential for human survival in the future. Human depend on other species for all of their food and for several medicines and industrial products.

Up to 80 per cent of the people in developing countries depend on traditional medicine for primary health care, mainly of which is derived from plants and some from animal and mineral sources. In relation to the 20,000 species of plans are used for medicinal purposes in these countries. Almost one-quarter of all prescription drugs used in the urbanized world are based on plants, including 21 indispensable mainstream drugs. These contain aspirin from the plant *Filipendula ulmaria* and *Quinine* from the bark of many species of the *Cinchona* tree. In addition, plants contain intricate chemical structures which may be possible to synthesize in a laboratory, and which might give significant clues for new medicines. Genetic diversity is significant in breeding crops and livestock. The loss of crop species has severe implications for global food security. Crop breeders require a diversity of crop diversities in order to breed new diversities that resist evolving pests and diseases. Several crops have been "rescued" with genetic material from wild relatives or traditional diversities.

Sugarcane in India, for instance, was prone to the red rot disease which limited its commercial manufacture. Resistance to the disease was acquired from the genes of the wild cane *Saccharum spontaneum* from Indonesia. Genes from a wild rice from India resurrected rice farming in several 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 establish it only in one – a single example of *Oryza nivara* composed from eastern UP in 1963. The strain of rice evolved through by that example is now widely grown all in excess of South and South-east Asia.

Biodiversity, so, symbolizes a "livelihood library of options for adapting to local and global change." Perhaps the mainly significant value of biodiversity is in its providing solutions to several troubles of an unforeseen and an undesirable future.

India's Biodiversity

As we talk about India's biodiversity we become aware of the centrally of Indian situation in the rich biodiversity of the country.

It is notable that a wide diversity in physical characteristics and climatic situations has resulted in a diversity of ecological habitats like forests, grasslands, wetlands, coastal and marine ecosystems and desert ecosystems. Several national and international agencies and conventions have acknowledged India's potential in conditions of biodiversity. The two prominent characteristics 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 recognized eight such centres approximately the world in 1951. He "classified the world's crop producing regions into eight centres of plant origin. Of these regions of crop genetic diversity, India was central to what he described the "Hindustan Centre of Origin". Vavilov's terminology for India was well justified, for this region has produced a important share of the major crops used the world in excess of. At least 166 species of crops and 320 species of wild relatives of cultivated crop species are whispered to have originated here".
- ***MEGADIVERSITY:*** India is one in the middle of the seventeen 'megadiversity' countries in the world, a concept which was introduced through 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 through World Bank and other World bodies for species diversity and endemism in the World's selected few rich floral and faunal zones. "Presently 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 effort to prioritise conservation efforts approximately the world. More than half of the

world's forests have already disappeared, and more are destroyed each year. Thousands of species, mainly of them strange to science, are being led to extinction. Filled with the beauty and diversity of landscapes, plants, and animals from approximately the world, this video explains the Megadiversity approach and highlights the biologically extra ordinary countries. Megadiversity is not only a concept, it is a call for action to ensure the survival of all shapes of life on earth. Two spots recognized as 'Megadiversity' and 'Hot Spots' in India are North-eastern Himalayas and Western Ghat. But India as a whole has been marked a megadiversity region. Indians are not yet extremely much conscious and concerned in relation to the biodiversity loss and degradation of whole ecosystem. As the conservation require is urgent in the face of depletion India requires a well intended strategy to protect these resources.

The sharing of biodiversity in India is also significant. India, which occupies presently two percent (2.4%) of the total landmass of the world, harbors a rich biodiversity comprising in relation to the 8% of the recognized biodiversity of the world. For our purposes, a broader picture of bio-diversity sharing will emerge if we divide the sharing in quantitative and geographical conditions. A glance at some of the numerical estimates of the well-known categories of livelihood organisms would provides us some thought of our biodiversity wealth. India has:

- 81,000 species of animals, which comprises 50,000 species of insects and 12,000 species of birds; it also has
- 45000 species of several other categories of plants that contain 15,000 species of flowering plants.

It has to be borne in mind that these figure are based on survey of in relation to the 70% of the geographical region of the country the results of which have been recorded. A vast region yet requires to be surveyed and documented. Further, there are many sub-species which in turn may have countless diversities. The biodiversity that our country has is widely

distributed through its length and breadth. Several attempts have been made to classify them in conditions of geographical regions. The mainly accepted and followed classification is the one urbanized at Wildlife Institute of India through Rodgers and Panwar (1988). It divides India into 10 bio-geographic regions/zones. These zones reflect major species groupings. In addition, they have a separate set of physical, climatic and historical circumstances. The ten zones are:

- Trans Himalayan
- Himalayan
- Indian desert
- Semi arid
- Western Ghats
- Deccan Peninsula
- Gangetic Plain
- North-East India
- Islands
- Coasts.

Biodiversity Depletion & Conservation

In spite of the recognized benefits of biodiversity, we are faced today with a problem of accelerated depletion of life shapes. The main factors of this depletion have been human interventions and habitat destruction, in excess of use for commercial causes, accidental or deliberate introduction of exotic species, loss of gene flow, outbreak of diseases, rising pollution (air, water and land), climatic and environmental changes etc. This is in addition to the natural rates of extinction of life shapes. The end result has been extinction of several species altogether while still others are threatened. It requires to be pointed out that several species may have been lost without being documented. Another alarming aspect of this problem is that even if all human behaviors were to cease immediately, species extinction due to impacts that have already taken lay would continue for decades. Some instances of biodiversity loss in India, are:

- Several animals have become extinct like cheetah, pink-headed duck while several more are very threatened and endangered;
- In the middle of plants, out of 15000-16000 species of flowering plants in relation to the 10% have already approach under several categories of threatened plants. Just as 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 unusual while 34 have been insufficiently seen;
- Through 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 in relation to the 80%;
- The revise of 'hotspots' shows that out of 18 regions or 'hotspots' that are characterized through 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 extremely noticeable in the Damodar and Hoogly rivers in West Bengal, Choliyar river close to Calicut and Kalu river close to 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 events. Conservation efforts are particularly necessary in the wake of loss of life shapes on a daily foundation. In India, conservation practice based on local knowledge systems and society efforts date back to many centuries. In the contemporary era scientific agencies have mapped several life shapes and prepared a taxonomic database. The Botanical Survey of India,, the Zoological Survey of India (1961), and the National Institute of Oceanography jointly with several organisations and universities are involved in survey and documentation of life shapes. What is needed is a comprehensive strategy to conserve the languishing biodiversity. This can be

done in two ways; **Ex-situ conservation** – off location conservation, and **In-situ conservation** – on location conservation.

- ***Ex-situ conservation:*** Ex-situ conservation refers to conservation of life shapes in regions 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 causes of aloofness, logistics or legality, its conservation in natural habitat is not possible. Ex-situ conservation can be done in dissimilar ways:
    - Through establishing zoological parks and botanical gardens;
    - Through research centres, aquaria and alike organizations; and
    - Through applying in-vitro storage techniques for the conservation of plant biodiversity field gene banks and seed banks;
    - In case the concerned species shows signs of recovery and propagation at the ex-situ locations, they can be re-introduced in the wilds.
- ***In–situ conservation:*** In–situ conservation applies to conservation of the threatened species in their natural habitats. In situ conservation can be accepted out in the following regions:
    - National Parks and Sanctuaries;
    - Reserved and Protected Forests;
    - Biosphere Reserves;
    - Nature Reserves.

The Government of India has taken a diversity of steps to ensure biodiversity conservation. While some of them are directly and specifically targeted at conservation of life shapes, other play an incidental role in rehabilitation and propagation of dissimilar species and ecosystems. These events may be listed therefore:

- Approximately 4.2% of the total geographical region of the country has been earmarked for Protected Regions, National Parks and Sanctuaries. India has 85 National Parks and 498 wildlife sanctuaries.

- Several projects like Project Hangul, Tigers, Lion, Brow-Antlered Deer, Elephant, Crocodile etc. have been launched in protected regions for conservation of threatened species.
- To conserve representative ecosystems, ten 'Biosphere Reserves' have been shaped. These reserves also serve as laboratories for evolving alternative models of development.
- Several programmes and action plans have been launched for scientific management of fragile ecosystems like Wetlands, Mangroves, Coral Reefs, deserts and other regions.
- In pursuance of ex-situ conservation, the government has set up many zoological and botanical gardens. There are in relation to the 70 Botanic Gardens including 33 university Botanic Gardens. There are also approximately 275 centres of ex-situ wildlife preservation in the form of zoos, deer parks, safari parks, aquaria etc. A Central Zoo Power has also been shaped.
- Many legislations like Wildlife Protection Act, Forest Acts, Environment Protection Act etc. have been enacted to protect and propagate life shapes.
- 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 many 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 organizations, experts and lawyers are also being undertaken to evolve a viable methodology for protection of our biodiversity.

The government efforts have to be matched through 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, enough bio-reserves, bio-parks etc. have to be set up in dissimilar agro-ecological and bio-climate regions.
- For ex-situ conservations, there is a require to build more resource centres, conservation parks and germ plasma banks of several types.
- There has to be a huge awareness generation and mass mobilization programme focusing upon the importance of biological wealth. Biodiversity conservation has to be a national effort.
- Research behaviors pertaining to biodiversity should be given greater attention and survey of hitherto inaccessible regions like the Himalayas, Andaman and Nicobar Islands and Exclusive Economic Zone should be accepted out.
- Strict enforcement of rules and regulations particularly in biologically degraded regions are needed.
- Preparing a comprehensive database in the form of a Biodiveristy Register is also extremely significant.
- Involvement of tribals, rural societies NGO's and other grass root organizations in species management plans is of great help. Traditional wisdom and society efforts at preservation of biodiversity are now increasingly being applauded. The require is to involve them in a comprehensive method. Some experts have also floated the concept of People's Biodiversity Register (PBR).

People's Initiatives

There are ample examples where people, rural societies, tribals, village folk in association with academician, NGO's researchers and in some cases with government officials have shown extra ordinary enterprise in management of life-shapes. Let us have a seem at some of the examples.

- The Bishnoi society spread in excess of Barmer, Jodhpur and Jaisalmer district of Rajasthan have been successfully preserving the Khejri trees, the pea-fowl and sure mammals like the chinkara, nilgai and the black buck. They are enjoined through their religious traditions to preserve nature.

- There are several examples of women involvement in biodiversity preservation from Himachal Pradesh. Women organized into *Mahila Mandals* have successfully protected patches of forest all in excess of Karsog in Mandi district. Likewise Mahila Mandals are protecting forests in Chular valley of Mandi from timber smugglers and sometimes from their own men.
- The Nature Conservation Civilization (NCS) shaped in 1976 through 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.
- *Navdanya* is a grossroots people's movement for in-situ conservation of genetic resources connected to agricultural crop diversity in the Garhwal- Deccan region.

These are extremely few examples, to demonstrate people's skill is conserving our biological wealth. The require in to emulate and prorogate such efforts in other parts of the country.

ENVIRONMENTAL RESOURCES AND PATENTS

Convention of Biodiversity

Biodiversity (biological diversity) is the word used to describe all livelihood organisms their genetic make up and the societies they form. Global theory views the planet earth as an integrated and interdependent ecosystem. Concerns have been rising amongst scientists, policy makers and public at the accelerating loss of biodiversity resulting from human impact. International efforts at conserving life shapes are not new. " There are in excess of 150 bilateral, multilateral and global treaties on environment." Several of these deal with several characteristics and parts of biodiversity, starting with convention relating to Fauna and Flora in their Natural State, 1933. But mainly of these were specific and sectoral in nature, and there was a require 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 through 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 through several, bio-diversity conservation is today as much political an issue as any other. The core debate is woven approximately 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 through the developing world the IPR regimes like TRIPS hamper the former, through laying down strict IPR events, and encourage the latter through not checking bio-piracy. Vandana Shiva, a noted activist, has explained contradictions of the crisis at hand in a precise manner therefore:, " While the crisis of biodiversity is focused as an exclusively tropical and third world phenomenon, the thinking and scheduling of biodiversity conservation is projected as a monopoly of institutes and agencies based in and controlled through the industrial world".

Both urbanized and developing nations (more than 150 states) discussed these divisive issues in Rio de Janeiro in, 1992, and agreed on a convention which recognized 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 common 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 several characteristics of biodiversity such as identification and monitoring, conservation in natural or human customized surroundings, rational or sustainable use, creation of awareness, impact assessment of behaviors likely

to effect biodiversity, access to genetic material, safeguarding of relevant traditional knowledge and practices and exchanges of information and technology flanked by the countries.

But unluckily the convention remnants a weak instrument; it instructs the states to bring in relation to the sure 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 gives a method to do this. It is vague on several significant issues and ineffective in implementation which is its major drawback. **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 use their own resources pursuant to their own environmental policies, and the responsibility to ensure that behaviors within their jurisdiction or manage do not cause (harm to) the environment of other states or of regions beyond the limits of national jurisdiction".

This is measured to be the mainly significant article of CBD, which rejects the 'general resources' and 'general heritage' argument put forward through the urbanized world. Through by this general 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 'general heritage'. They instead pressed for and got accepted the principle of national sovereignty in excess of biological resources.

Another Article 8(j) of the Convention of Biodiversity reads:

- "Subject to national legislation, respect, preserve and uphold knowledge, innovations and practices of indigenous and local societies 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 utilization of such knowledge, innovation and practices".

This stage again stresses that use or use of biological resources including traditional knowledge necessity provide rise to equitable shared benefits. Secondly it also lays emphasis on preserving practices, which is extremely significant for continuation of related lifestyles. Although these formulations are weakly and unclearly worded, they could job for the advantages of developing nations and traditional societies given adequate pressure for strengthening them. These are some of the Articles, which are central to the subject under discussion here and may also discover mention in the ensuing sections. Separately from these, Article 16(2) says: "Access to and transfer of technology to developing countries shall be provided and/or facilitated under fair and mainly favourable conditions, including on concessional and preferential conditions where mutually agreed and where necessary, in accordance with the financial mechanism recognized through Articles 20 and 21". Likewise Article 16(5) of the CBD also enshrines principles aimed at resolving potential conflicts.

Deal Related Characteristics of Intellectual Property Rights (Trips)

In 1993 the World Deal Organisation (WTO) gave a package of agreements in which there was one agreement that was described the agreement on Deal Related Characteristics 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 Deal Related Characteristics of Intellectual Property Rights (TRIPs) is the mainly 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. So, through 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 industrialized countries that inadequate patent protection had eroded their advantage in higher technology regions. The TRIPS agreement was pushed through the urbanized countries, who were its

primary benefactors. The developing countries on the other hand did not provide willing consent to TRIPs and relented only on sure circumstances.

It is whispered that the arm-twisting done through US through imposing several stringent bilateral IPR agreements on a number of nations prior to TRIPS was the real cause for developing countries to agree to TRIPs. It was felt through several nations that a uniform global regime was better than bilateral agreements of the type 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 necessity is 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 provision of patent protection in TRIPs is given under Article 27. This requires the patents to be granted in all meadows of technology for the procedure and products simultaneously. Therefore biological procedures and their products both approach under the manage of a patent regime. There has, though, 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 procedures for the manufacture of plants and animals other than non-biological and micro-biological procedures. Though, the members shall give for the protection of plant diversities either through patents or through an effective *sui-generis* organization or through any combination thereof. This provision shall be reviewed four years after the date of entry. This is the mainly controversial Article in TRIPS related to environmental issues. This Article currently requires all member states to give protection for intellectual property, either through patents or an ‘effective *sui generis* organization’ or both for plant diversities. No effective definition is given, yet developing countries necessity put such systems in lay if they choose this as an alternative to patenting and if they wish to avoid punitive deal sanctions.

Mainly developing countries have already taken or are scheduling 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 through Union for the Protection of Plant Diversities or UPOV. This is unfair and uncalled for. UPOV is not mentioned in the TRIPs agreement whereas the other relevant IPR treaties are. Self-governing legal and economic experts have reiterated in several publications that UPOV's offering should not be swallowed as an effective *sui generis* organization and that there is ample scope for maneuver, flexibility and national discretion in interpreting the *sui-generis* option. *Sui generis* protection provides members more flexibility to adapt to scrupulous circumstances arising from the technological features of inventions in the field of plant diversities such as novelty. *Sui generis* effectively means a self generated organization that is specifically intended to protect specific plant diversities.

Another provision that deals with environment related issues is Article 27.2. As stated through Jayashree Watal "TRIPs does deal with the ethical, moral characteristics of biotechnology (and other technologies) or biosafety through allowing under Article 27.2 patent exclusions of inventions 'the prevention within their territory of the commercial use 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'. Therefore while such exclusions can be made, the caveat that the prohibitions of commercial use were necessary would apply. This also means that countries that choose to exercise this option would then forego the benefits of the new innovations.

Many studies have shown that all bio-technological innovations in the field of agriculture or medicine are based on or urbanized from bioresources. Traditional knowledge resources in developing countries are being stolen without any compensation or even acknowledgement. Just as to sure analysts since micro-organisms are livelihood organisms, their patenting could be the slippery route that could lead to patenting of all life shapes.

Contradictions and Conflicts

The TRIPS agreement appears to further the hypothesis that only the intellectual contributions of the corporate-sponsored scientists require intellectual property protection and compensation. It pays no attention to the information 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 mainly society's livelihood in the third world countries. Convention of Biodiversity recognizes this information and gives protection to these biological resources and knowledge and prevents their use. This variation in approaches and focus of the two agreements provides 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 stages namely,-

- Objectives,
- Principles, and
- Legal Obligations.

CBD and TRIPS: Conflicting Objectives

CBD strengthens the capacities of the developing countries' to conserve and use biological diversity on a extensive-term foundation, taking into explanation all their rights in excess of those resources including the right to enjoy the benefits of their resource base. Though, due of unequal sharing of capital resources and technological prowess flanked by countries rich in biological diversity and those that have well urbanized economic and legal structures, the South has been uniformly exploited. The CBD is intended with the intentions of remedying this anomaly. Therefore its unstated objective is also to give a platform to South from where it can enter the region 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 through requiring prior informed consent and sharing of benefits;
- Providing for transfer of technology from North to South.; and
- Recognizing the communal rights of local societies 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.

The objective of TRIPS is to make available proprietary claims and rights in excess of products and procedures. These products/procedures 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 planned in TRIPS are likely to guarantee monopoly of the products and procedures to the people and groups who set up inventions of new plants and micro-organisms etc. and/or procedures related with them.

As stated through 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 totally dissimilar directions. It is likely that a country, which in all good faith seeks to implement society rights, and does so within the CBD framework, could discover itself in serious contravention of the TRIPS Agreement". For instance 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 attempt 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 dissimilar nations to exercise absolute national, sovereign rights in excess of their biological resources. On the contrary TRIPS would subject biological resources to private proprietary manage. Obviously there develop contradictions flanked by national sovereign

rights and private proprietary controls. It would also imply that countries posses the right to prohibit IPR applicability on life shapes. 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 procedure, as well as patents and/or *sui generis* protection of plant diversities be made applicable.

Biological Resources and Traditional Knowledge

CBD holds that the use or use of biological resources and traditional indigenous or society knowledge necessity provide rise to equitably shared benefits. But TRIPS contradicts this through laying down that patents necessity be provided for all meadows of technology, so the use or use of biological resources necessity be protected through IPR. There is no mechanism for sharing benefits flanked by a patent holder in one country and the donor of material in another country from which the invention is derived. Basically put, CBD provides developing countries a legal foundation to demand a share in benefits. TRIPS negate this legal power.

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 societies. But under TRIPS regime there is no provision requiring prior informed consent for access to biological resources, which may subsequently be protected through IPR. Principle of prior informed consent is expected to diminish the incidence of bio-piracy, although doubts have been raised in excess of its implementation. TRIPS would ignore this power and therefore promote bio-piracy.

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 general concern of human type taking into explanation all rights in excess of biological resources. TRIPS has sure token provisions to protect public health and morality but in actual working the safeguarding of public health, nutrition and public interest

in common have been subjected to the private interests of IPR holders. Hence both the agreements differ in emphasis; former lays emphasis on common and society interest whereas the latter strengthens private property and vested interests. In other languages the agenda of TRIPS is to privatize, not protect biodiversity.

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, livelihood organisms and information and sharing 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 seeks to bring even livelihood 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 through nature are exclusive in character i.e. they prevent the use of the substance or procedure through anybody else. If the respective state fails to act under TRIPS, it can be compelled to do it through the Dispute Resolution Mechanism. Hence we see that CBD facilitates transfer of technology whereas TRIPS may hamper this.

Growths in India

We shall talk about 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 distant 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 gives for the establishment of the National Biodiversity Power at the Central stage, State Biodiversity Boards at the State*

stage and Biodiversity Management Committees at the stage of the local self-government in India. The CBD stresses on the sovereign rights of the states in excess of its bioresources and recognizes the rights of the societies in excess of 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 bioresources and the traditional knowledge thereof through presently taking the permission from the State Biodiversity Boards. This may lead to collusion flanked by Indian Corporations/Citizens and foreign multinational Corporations.

The exclusive jurisdiction to decide access to genetic resources and traditional knowledge rests with the National Biodiversity Power. It has been criticized on the ground that the power is neither autonomous nor self-governing nor democratic. Although the Act, through Part 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 Part. This enables not only Indian industries but also foreign corporations to manufacture and sell several plant-based products, for instance *Ayurvedi*c medicines, without the permission of the National Biodiversity Power. Evidently the Act in it-self is a welcome development but since it suffers from sure vital flaws it would require major restructuring if it were to achieve its objective.

The Protection of Plant Diversities 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 diversities and farmers diversities notified through the Central Government. The criterion of granting protection has been deemed to be novelty, distinctiveness, uniformity and stability. The Act also provides the Central Government power to exclude any genera or species from protection on the ground of public interest. As the Act does not describe 'Public Interest' it is opined that this provision provides enormous and unabridged powers to the Government. Again in the case of 'benefit sharing' as required under the CBD, this Act gives that this can happen only if the Central Government notifies this. Considering the stage 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 appears to be a half-hearted and piecemeal measure to somehow wriggle out of an international obligation. The *sui generis* regime appears to be weak and impaired through implementation troubles. The intention appears to be to fulfill India's obligation without causing any major variation in the ground situation. Although several have criticized this approach we discover that this (Act is vague and on the whole vests big powers with the Central Government. Government can, through by the public interest clause, protect several livelihood species and knowledge form being patented which can be an effective method to bypass some of the ill effects of TRIPS and prevent any disagreement with principles of CBD.

Case Studies

Neem

Neem (*azadirachta indica*) tree grows widely in India. From a extremely early time in history the medicinal and curative properties of Neem have been recognized to Indians. The parts of this tree have also been, likewise used for the purposes of pesticide and also sometimes as fertilizer. Numerous *neem* products have received patents. Many of these have been granted to Indian companies for a range of products. Though, the patents which are at the center of a controversy are the ones granted to US company W.R.Grace for extraction and storage procedures. 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 procedure to extract oil from the *neem* tree.

The W.R.Grace patents have resulted into a situation of disagreement. The Government of India filed a complaint to the US Patent Office accusing the multinational for copying the Indian invention. Though in the end, the government withdrew its complaint with regard to the first two patents.

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 through three Indian parties, on the ground of 'lack of novelty' and stated that it amounted to **biopiracy**. It was establish that a manufacturer from Delhi, Abhay Pathak who was in the *neem* business for 25 years, had urbanized a procedure 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 through EPO since 1989.

This case exhibits how traditional society knowledge is being exploited through multinationals. Medicinal and other qualities of *neem* have been a part of general knowledge and age-old custom in India. Indian farmers have used *neem* as pesticide since ages. This knowledge is hijacked through the multinationals and used as the foundation for further research without any remuneration or even recognition to the indigenous societies (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 urbanized these products in excess of centuries. It necessity be reminded that a big number of patents are still valid under the IPR regimes and only a few have been cancelled. Such patents are recognized 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 several plants for the treatment of jaundice. *Phyllanthus niruri* is one such medicinal plant used widely in India. It is a part of Ayurvedic organization as well as of local and society traditions. The plant is described *Bhudharti* in Sanskrit, *Jar Amla* in Hindi and *Bhuin Amla* in Bengali. 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 give 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 case. One can extremely clearly see that even in their working the two agreements are divergent. It is also apparent that under the present patent regime environmental resources are always prone to use.

ALTERNATIVES

Development – Gandhian Alternatives

The development priorities of India and their viability began to be measured seriously as a realistic proposition in the foreseeable future through the leadership in national movement in the 1920s. As the prospects of independence became brighter the discussions on developmental model for self-governing India too became intense and elaborate. There were now two major protagonists – Gandhi and Nehru who supported two dissimilar 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 contemporary, industrial model of development. As the mainly appropriate proposition for India, Gandhi whispered, the path to progress and development passed through villages. The Gandhian model of development therefore steered clear of the modernization based on the heavy industry mode of development. At first perhaps the Gandhian model would seem somewhat anachronistic, but a scrutiny of its underlying tenets would

reveal an analytical, organized organization at job that clearly provided a viable alternative to the contemporary industrial mode of development.

The Gandhian model of development is, in its mainly compact form, discussed in *Hind Swaraj*, a text of seminal significance in as distant as outlining the broad contours of Gandhian philosophy of culture 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 House Rule – translated through Gandhiji himself), gives valuable theoretical and methodological insights into Gandhian idea and vision of Indian nation. It is here that one is enabled to seem at several of the revealed and hidden concepts of Gandhian idea and action. *Hind Swaraj* also unfolds, in the middle of many other notions, Gandhi's precepts of 'true civilization' and his delineation of the conduct for the polity of nation-India to model itself upon for attaining 'homerule'. *Hind Swaraj* is not a narrative text, but a critical dialogue addressing troubles of understanding and explanation. Unlike the documentary conception of a text, it is an imaginative reconstruction of existed experience which is suggestive of some of the mainly important and subtle procedures at job in the transformation of Indian civilization and polity under colonial dispensation.

It signals the require 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 civilization. The organizing mechanism of this village civilization within the coordinates of *Swaraj* unravels the principles of governance that can be legitimately termed as Gandhian ideals of development. Here we talk about 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: "Contemporary civilization shapes the broad historical context of *Hind Swaraj*. Its critique of that civilization is one of its main contributions to contemporary political idea. In historical

conditions, it is Gandhi's apprehensions in relation to the sure tendencies in contemporary civilization that made him the thinker and the political innovator that he is".

The views on development as given in *Hind Swaraj* may be outlined briefly as follows. The priority in development job should be given to villages and village industries. Since villages were the sheet anchor of democracy in India, the job of development should begin from there. A dissimilar focus, namely on heavy industries and on speedy modernization 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 mainly unlikely to either part with it or share it with the majority. Gandhi's disapproval of 'contemporary' and through consequence contemporary state is nicely explained through Parel therefore: "The Reader believes that the adoption of the contemporary state is enough for achieving self-government. Gandhi disputes this. He believes that the contemporary 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'.

The tiger is Gandhi's metaphor for the contemporary state: all tigers seek their prey, and it makes no variation 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". In his editorial in *Harijan* Gandhi wrote: "I would categorically state my conviction that the mania for mass-manufacture is responsible for the world crisis. Granting for the moment that machinery may supply all the requires of humanity, still, it would concentrate manufacture in scrupulous regions, so that you would have to go in relation to the in a roundabout method to regulate sharing; whereas, if there is

manufacture and sharing both in the respective regions where things are required, it is automatically regulated, and there is less chance for fraud, none for speculation.

"You see that these nations are able to use the so-described weaker or unorganized races of the world. Once these races gain an elementary knowledge and decide that they are no more going to be exploited, they will basically be satisfied with what they can give themselves. Mass-manufacture, then at least where the vital necessities are concerned, will disappear. "When manufacture and consumption both become localized, the temptation to speed up manufacture, in-definitely and at any price, disappears. All the endless difficulties and troubles that our present-day economic organization presents, too, would then approach 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 secure revise 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 contemporary 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 require not be fatal, provided a competent doctor can be establish in good time". The doctor in Gandhi was clearly conscious of the disease. As if through method of a prescription he wrote in the *Harijan* "I do not consider that industrialization is necessary in any case for any country. It is much less so for India. Indeed, I consider that Self-governing India can only discharge her duty towards a groaning world through adopting a easy but ennobled life through developing her thousands of cottages and livelihood at peace with the world. High thinking is inconsistent with complicated material life based on high speed imposed on us through Mammon worship. All the graces of life are possible only when we learn the art of livelihood nobly.

"There may be sensation in livelihood dangerously. We necessity draw the distinction flanked by livelihood in the face of danger and loving dangerously. A man who dares to live alone in a forest infested through 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 livelihood is possible for an in accessible nation, though big 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 skeptic. The answer is straight and easy. If plain life is worth livelihood, then the effort is worth creation, even though only an individual or a group makes the effort.

"At the similar time I consider that some key industries are necessary. I do not consider in armchair or armed socialism. I consider in action just as to my belief, without waiting for wholesale conversion. Hence, without having to enumerate key industries, I would have State ownership, where a big number of people have to job jointly. 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 nonviolence, I would not dispossess moneyed men through force but would invite their co-operation in the procedure of conversion to State ownership. There are no *pariahs* of civilization, whether they are millionaires or paupers. The two are sores of the similar 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-contemporary development could not be stated better.

Environmental Conservation – Chipko Movement

The conservation practices in India have traditionally been offering alternatives to the contemporary methods of conservation. These

alternatives have also approach as a result of misdirected priorities of contemporary methods and sometimes through method of a protest at the inherent mechanisms of use in ‘contemporary’ practices.

The Chipko Movement is often associated with the people of Uttarakhand’s thrash about launched in 1970s for the protection of the forests of the region. The roots of this movement may, though, be traced to an earlier era and may be related to the pernicious provisions in the Forest Acts of the British restricting the hill society from commonly by the forest resources for several daily purposes. The importance of these resources to the people of the hills of Uttarakhand has been aptly described therefore: “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 circumstances of heavy seasonal rainfall. They have also provided the mainly important input for sustainable agriculture and animal husbandry in the hills. Undoubtedly, forests give the material foundation for the whole agri-rustic economy of the hill villages. Green leaves and grass satisfy the fodder requirement of the farm animals whose dung gives the only source of nutrients for food crops. Arid twigs and branches are likewise, the only source of domestic cooking fuel. Agricultural implements and home frames require forest timber. Forests also give big amounts of fruit, edible nuts, fibres and herbs for local consumption”.

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 through the English settlers and through the rulers of the hill kingdom. The main stages in which the new events were implemented were as below:

- In 1850 the forests of the Garhwal region (mainly Tehri Garhwal) were taken through 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 manage of the local kingdom, the Tehri Garhwal rulers.

All the were aimed at restricting the villagers from by 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 events had become apparent towards the secure of the nineteenth century. At the beginning of the twentieth century the protests had assumed the form of loosely organized resistance. As accounted through Sunderlal Bahuguna, the protest of hill people against the forest policy of the rulers of Tehri Garhwal assumed an organized form in 1907 when Kirti Shah, the ruler of Tehri Garhwal, had to intervene personally to quell the people's anger. Though "the contradictions flanked by the people vital require and the State's revenue necessities remained unresolved" and, as described through Vandana Shiva and Jayanto Bandhyopadhyay, "in due course, became sharper. In 1930 the people of Garhwal began the non-cooperation movement, mainly approximately the issue of forest resources. Satyagraha to resist the new oppressive forest laws was mainly intense in the Rewain region. A huge protest meeting was organized 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 big number of unarmed satyagrahis were killed and wounded, while several others lost their lives in a desperate effort 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 them self-governing 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".

The Chipko Movement of the post-independence era in India therefore had a rich legacy of same forest movements in the region of Garhwal in Himalaya. The immediate event that sparked the Chipko Movement was the

stopping of forest felling through a group of peasants in a remote Himalaya village in Gopeshwar. The date usually 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 region where the incident took lay, had auctioned the trees on that region 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 symbolized 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 through a folk-poet of the region, Ghan Shyam Taturi.

"Chipko was representative of a wide spectrum of natural-resource conflicts", as described through Ramchandra Guha, "that erupted in dissimilar parts of India in the 1970s and 1980s: conflicts in excess of access to forests, fish and grazing resources; conflicts in excess of the effects of industrial pollution and mining; and conflicts in excess of the sitting of big dams. One can understand each of these conflicts sequentially, as an unfolding of the procedures 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 little timber for local societies 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 disagreement, namely industry, the other party, i.e. peasants, responded through communal action. Picked up through a press that is amongst the mainly voluble in the world, the protests then gave form to a debate on how best the Himalayan forests should be supervised – through societies, 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 society at big. Finally, this region

specific debate led in turn to a national debate on the direction of forest policy in the country as a whole".

The great significance of Chipko Movement lies in its being an alternative, people's initiative. The devastation heaped on the society of hill region through 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 nonviolent resistance. As stated through 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 lay in post-Independence India".

REVIEW QUESTIONS

- Is there an inevitable conflict between development and environmental concerns? Discuss and give different views on the subject.
- What do you understand by Biodiversity?
- What is meant by ex-situ and in-situ conservation? Describe.
- What are the main issues pertaining to the patents of environmental resources? Discuss.
- Discuss the characteristics of Gandhi's non-industrial model of development.
- Describe the genesis and character of Chipko Movement.

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