

Chapter

2



Ecology and Cultures In Pre-colonial India

We, as humans today live in a fiercely cut-throat situation on planet earth. The majority of the population thrives on the principle of mutually beneficial give and take, that is, you scratch my back and I will scratch yours. Anyone daring to break that mould could only survive at his own peril. Similar is the case with man and environment. If nature scratches our back by providing us with its resources continuously for centuries, we also need to take care of the earth. Till the time we were able to maintain a mutually beneficial ecological culture, there were no enduring problems, but the moment human footprint started making a permanent stamp on natural resources and ecology there has been an uncertainty over what future has in store for us. We need to know when and how did it all begin? What is the history of man and environment relationship? We start the history of environment from the stage when early humans became conscious of their surroundings to the extent that they began to consider how they could alter it to their advantage. In this sense, the origin of sedentary agriculture (10,000 years ago) may be considered as the beginning of environmental change by human activity, when instead of depending on environment, men began to manipulate it. During the earliest phase of human evolution, man's dependence on nature does not in any way differentiate him from animals. But the impact of man's activities is exclusively a creation of human beings, and this differentiated humans from animals. Human beings impressed their stamp on nature through hand and brain which kept changing its shape and size during its evolutionary phase. They were able to differentiate hand from foot (prehensile hands) and were able to walk erect (bipedal locomotion). Then the basis was laid for the development of articulate speech and development of brain. The size of the brain kept on increasing with man's interaction to the challenges of environment. The formation of the prehensile hands led to the use of tools and tools implied human activity. This in turn led to manipulating the nature and the environment and production of various sorts began. Man impressed his stamp on nature by manipulating the climate and ecology of his dwelling place. He did it by picking up what to breed and grow in the field and what not to. And, therefore, with the evolution of man and his interaction with ecology, we entered into the domain of environmental history.

Earlier, many scholars believed that environment determined the human activity throughout the history of mankind. Ellsworth Huntington was the main proponent of this theory of 'Environmental Determinism'. To him nature has not been a constraint to human activity, but very largely its determinant. Till 1960s this theory remained popular because the social scientists believed that human societies are affected by nature and environment at the local level. In one form, this was conceived as the influence that natural conditions exercise on humans. Today we have moved ahead from this concept of 'Environmental Determinism' and it is now being perceived that human activities have affected the environment to a large extent, and therefore, environmental studies has gained such an importance.

BEGINNING OF HUMAN INTERFERENCE IN ENVIRONMENT

Before the agricultural revolution nearly 10000 years ago, human groups survived on hunting and gathering in different parts of the world where this was possible. At that time, the world population was very thin. A large part of the earth, like America and Australia were virtually uninhabited until about 30,000 years ago. The earliest or primitive man is known as hunter-gatherer. In order to survive he hunted wild animals, scavenged dead animals and gathered fruits, roots, seeds and leaves from plants. The primitive man was not like the modern man, both in terms of appearance and social set up. His physical appearance underwent a change from that of an ape to the modern man through the process of evolution. In terms of social setup, he evolved gradually from a hunter-gatherer to a farmer-herder and then slowly moved on to become the technology savvy man that he is today. This development from hunter-gatherer to technology savvy man was a very slow and gradual process and it took thousands of years to reach this stage.

Before we proceed further, let us try to understand the evolution of modern human whose footprint has begun to show cascading impact on the environment. Why did the hunter-gatherers move from one place to another? During their stay at one particular place for long, they ate up all available edible plants and fruits and the animals they hunted moved elsewhere in search of grass. There could also have been a spell of dry season in which plants in that area did not bear fruit. Probably they also moved in search of water as the nearest source of water dried up. The invention of agriculture possibly enabled modern humans to settle at one place. That is why historians tend to call this beginning of agriculture as 'agricultural revolution'. The agricultural revolution probably enabled the expansion of the human population from roughly 50 million to about 200 million by first century AD and to 500 million by 1650 AD. Since that time, facilitated by the medical and industrial revolutions and developments in agriculture and colonisation of new lands, human population has

exploded, reaching about 1000 million by 1850 AD, 2500 million by 1950 AD, roughly 6000 million by 2000 AD and 6700 million in the year 2008. The pace of growth over the recent years has been such that while it took almost 200,000 years to produce our first billion human and 130 years to produce our second billion, the third billion was produced in only 30 years, and it just took 14 years to grow to four billion. The time taken for per billion production is getting reduced day-by-day. Now the humans have become the most numerous mammalian species on the earth. The result is that the humans 'consume more than 40 per cent of the world's total Net Primary Productivity (NPP)' (Hartmann, 2004, 15). NPP is the measure of sum total of energy and food available to all species on the earth. This population explosion on the earth is in itself the most important cause of the transformation of nature.

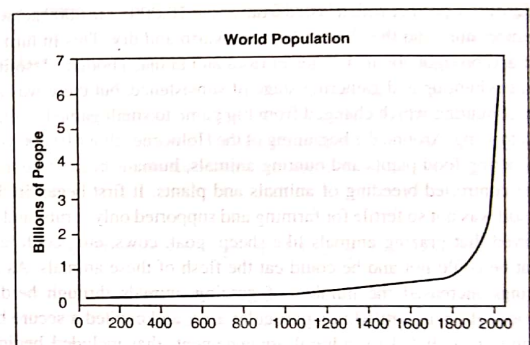


FIGURE 2.1 World Population Growth Trend

Historians believe that the most decisive role has been played by the growth and development of culture and technology. Largely speaking, world has witnessed three main phases – hunting and gathering; plant cultivation, animal keeping and metal working (domestication and food production); and modern urban and industrial society.

Implication of Hunting and Gathering

In the Stone Age, the tools used by humans gradually became more sophisticated, more varied and more effective. The tool technology enabled greater exploitation of plant and animal resources. Another feature of early society which seems to have distinguished humans from the surviving non-human primates was their seemingly omnivorous diet. Tools recovered from settlements in many different

parts of the world point towards the fact that in the Palaeolithic Age humans secured a wide range of animal meats. One consequence of enlarging the range of their diet was that, in the long run, humans were able to explore a much wider range of environment. Fire was another significant discovery which worked as a major agent for humans for which they have to influence their environment. It was one of the greatest achievements of Palaeolithic man around 250,000 years ago. Man learnt to produce fire by rubbing one stone with the other. Fire provided him with light, warmth and protection from wild animals. Later, they also learnt to cook food. Besides the effects of fire, early civilizations may have caused diffusion of some seeds and nuts, and through hunting activities may have had some effects on animal extinctions. Another major difference that set humankind above the animals was the development of communicative skills, such as speech, and later, writing.

The Mesolithic period, which lasted from about 10,000 BC to 8000 BC, witnessed a rise in temperature and the climate became warm and dry. This in turn affected human life and brought about changes in flora and fauna. Though Mesolithic man was still in the hunting and gathering stage of subsistence, but there was a shift in the pattern of hunting which changed from big game to small game hunting and to fishing and fowling. Around the beginning of the Holocene, about 10,000 years ago, besides gathering food plants and hunting animals, humans began to domesticate through the controlled breeding of animals and plants. It first began in the areas where the soil was not so fertile for farming and supported only scrubs and grasses. Man observed that grazing animals like sheep, goat, cows, etc., could eat those grasses that he could not and he could eat the flesh of these animals. As a result, human beings increased the number of grazing animals through herding and domestication. Humans settled in a particular area, and created a secure basis for survival through it. It led to cultural advancement, that included beginning of civilization and the 'urban revolution' as suggested by V. Gordon Childe.

About the same time, the human beings also discovered that they could replace inedible forests into edible crops. They observed that a plot of land that could produce only enough food to feed few people, could be used to produce food for more than a hundred people. This led to the beginning of cultivation or agriculture. One of the popular theories among historians on the origin of domestication is that it was born due to crowding, possibly brought about by a combination of climatic deteriorative conditions (post-Glacial progressive desiccation) and population growth. Such pressure, according to V. Gordon Childe, forced communities to intensify their methods of food production. In fact, food production or the cultivation of grains and edible plants is a phenomenon of the last 12,000 years of human existence. A large portion of earth's surface was earlier covered with ice sheets. At the onset of the Neolithic Age, these areas became habitable and climatic conditions were much warmer. As a result, forests had dense growth and many

areas which had earlier been dry became open grasslands. The hunter-gatherers of the earlier times in Mesolithic period were quick to learn from the new climatic conditions through observation. They came to know about the places where edible plants were found or grew naturally in a particular season. They also observed how seeds broke off from the stalks, fell on the ground and new plants sprouted. Gradually people started producing cereal grasses and became farmers. At the same time, people learnt to domesticate animals for their own use and they became herders. The stone tools made by men of Neolithic Age were well-shaped and polished in comparison to the tools of Palaeolithic Age. They also made hand axe with wooden handle and digging sticks for tilling the soil. During this phase, people entered a new stage of culture. Instead of depending entirely on the resources of nature for survival, they started producing their own food by cultivating cereals, such as barley, wheat and rice. They also started domesticating some species of animals. The beginning of domestication and herding is quite significant in the sense that men did it both for supplies of milk and meat as well as for their daily work. People domesticated animals to use them in their agricultural work. And for this purpose they selected relatively gentle animals such as sheep, goats, cattle, dogs and horses. These animals also supplied them wool and skin which he used for making clothes.

Implication of Domestication and Food Production

Domestication of plants and animals led to the emergence of village communities based on sedentary life, beginning of new ways of agriculture and exploitation of natural resources. The transition from hunting-food gathering to food production meant that through human intervention some plants were grown more while others were not. When people began producing food (beginning of agriculture) for themselves and for their cattle, it meant that they had to live at the same place for a longer time to look after the plants till the grain ripened. After the grains were collected, they had to be stored at a proper place so that it could be used till the next cultivation. Probably this need for storage of grains led to the beginning of pottery-making in the Neolithic Age. Earthen pots were also used for cooking food. Slowly people began weaving cotton into clothes. The making of pottery, weaving, spinning and transportation was also made possible due to another major achievement of the Neolithic man – the invention of wheel.

One of the related important development in agriculture was irrigation which had a rapid and early effect on environment. The use of plough and carts led to more intensive farming and enabled the transportation of its products. Environmental historians believe that domestication of animals and cultivation of plants have been

among the most significant causes of the human impact on environment. Pastoralists have had many major effects on soil erosion. Many historians argue that agriculturalists deliberately transform nature in a way which nomadic pastoralists could not do. By ploughing and seeding the grasslands, farmers eliminated a hundred species of native herbs and grasses, and replaced them with wheat or corn. Whereas people once enjoyed a highly varied diet, and used several thousand species of plants and several hundred species of animals for food, with domestication their sources were greatly reduced. For example, today four crops (wheat, rice, maize and potatoes) at the head of the list of food supplies contribute more tonnage to the world total than the next twenty-six crops all together.

Implication of Modern Urban and Industrial Society

A major development in human cultural and technological life was the introduction of new techniques to enhance human power. Humans discovered to extract mineral ores from the earth. They learnt to smelt pure metals from it and then made powerful tools from these metals. Metal working required enormous amounts of wood to generate heat. This led to huge amount of wood cutting from the forests. Later, however, about 900 years ago, humans discovered coal below the surface of the earth. The exploitation of coal reduced their dependence on wood. This also allowed them to cut more forest land and convert it into crop land to produce more food for themselves and the cattle. If we look at the global level, the historical

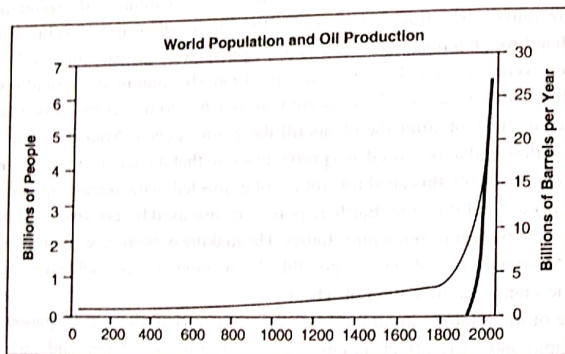


FIGURE 2.2 Correlation between World Population Growth and Oil Production

movement of people had been away from the equator. Many historians connect this to the availability of fuel. Thom Hartmann went to the extent of suggesting that 'the availability of a fuel leads to the emergence of population that depends on it, that will suffer if it is taken away. Had our ancestors ran out of the coal, nature would have taken over and limited their population.' When oil replaced coal as the alternative fuel in the late nineteenth century, our ability to produce food increased immensely. Oil was also used for synthesis of synthetic fabrics, like nylon, rayon, polyester, etc., and plastics. Now since we could produce clothes from oil, lesser land area was required for sheep-grazing and cotton production. It allowed men to use maximum area for food crop. Oil was also used to enhance food production through the use of fertilizers and tractors for irrigation. Many believe that ever since the use of oil has dominated, the population of the world has exploded. When we compare oil production and population growth curve we can observe such a trend (See Figure 2.2).

Very much attached to this proposition is the fact that with the decline in oil supplies, food production will be affected. It is probable that in the coming years, most nations will preferentially allocate oil and natural gas resources to agriculture. Over the next few decades, the food supply which is a key to maintaining our burgeoning population, will come under increasing pressure, and will be subject to its own inescapable decline. Ever since the ancient times, the surplus production of food allowed humans to feed a large non-producing class who lived in cities. As a result, a large number of cities grew with considerable human population. Such cities exercised a considerable influence on their environment, but this influence was not as far-reaching as the last few centuries particularly since the eighteenth century that witnessed the growth of machine based industries. This change over the large scale production is known as Industrial Revolution. The Industrial Revolution brought with it huge engine, like internal combustion engine. This meant colossal increase in human access to energy, and thus the human beings dependence on animal power lessened. Modern science and technologies were now used for agricultural production. There were humongous progresses made through the use of fertilizers and the selective breeding of plants and animals ever since the nineteenth century. But all these came with huge cost. It is from this phase of human history that the real and irrecoverable impact of human activities on environment began. The process is still on and it has started showing its cascading effect on the local as well as global climatic conditions. Thus, we are able to recognize certain trends in human manipulation of the environment in the modern era. We shall find in the ensuing case studies, how did the environmental impact related issues that were once confined locally later on became regional or even global problems.

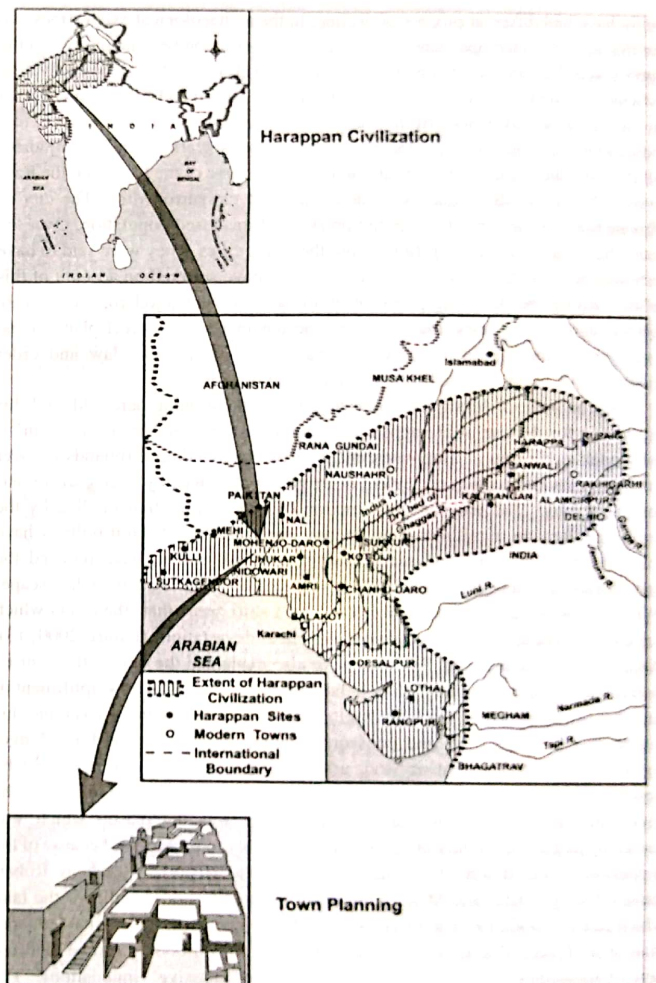
ECOLOGY AND HARAPPAN DECLINE

Harappan civilization or Indus civilization is one among the four contemporary Bronze Age civilizations of the ancient world. The other three are Mesopotamian or Sumerian on the banks of the Euphrates and the Tigris Rivers, Egyptian in the Nile River Valley, and Chinese on the bank of Hwang-ho River. The Harappan civilization mainly developed on the Harappa-Ghaggar-Mohenjodaro axis in the north-western part of the Indian subcontinent. It is known as the Harappan civilization because it was discovered first in 1921 (although noticed in 1826 by Charles Mason but not excavated) at the modern site of Harappa. The Harappan civilization is also called the Bronze Age civilization because the technology of making bronze items played a very significant role in the growth of urban centres of this civilization. Like all other contemporary civilizations, it was also developed in the river valleys. The river valley and its plains had the potential to produce a large surplus because of the fertility of the soil inundated by the annual flood and the easy availability of water for irrigating the field. The surplus production on a regular basis led to the sustenance of non-agrarian specialists, like artisans, traders and rulers who controlled and redistributed the surplus. They all lived in an area which was away (not far enough) from the agricultural field, gradually leading to urbanization. V. Gordon Childe says that urbanization was closely related to technological advancement, metallurgy, surplus production, specialization, class differentiation, and state formation. All these elements, combined with the invention of writing, together constituted the urban revolution which in turn ushered in this civilization.

Out of the hundred odd sites, the civilization is still best known by the two sites of (i) Harappa, on the river Ravi in Montgomery district of Western Punjab and (ii) Mohenjodaro on the Indus river in Larkana district of Sindh, on account of their size and the diversity of finds that have come to light. The Harappa culture was not confined to any restricted area. As a result of archaeological excavations since 1946, it is now clear that the Harappan civilization was geographically very extensive. It covered parts of Punjab, Sindh, Baluchistan, Gujarat, Rajasthan and the fringes of Western U.P. It extended from Jammu in the north to Narmada estuary in the south and from the Makran coast of Baluchistan in the west to Meerut (Alamgirpur) in the northeast. The area formed a triangle and accounted for about 13 lakh sq. kms., which is larger than ancient Egypt and Mesopotamia. No other cultural zone in the third and second millennium bc in the world was as large as the Harappa zone.

Causes of Decline

Around 1750 bc, the urban life culture of the Harappan cities broke up, although decline seems to have started earlier. The timing of decline of various Harappan cities varied. Various causes have been attributed to this trend since different cities



MAP 2.1 Extent of Harappan Civilization

might have had different process of decline. In the archaeological excavations, we see that at all the Harappan sites, planning and construction became inferior in the upper levels. It is pertinent to know that the upper levels found during the excavation indicate a cultural zone closer to the contemporary period and further lower level indicate a cultural zone closer to the contemporary period and further lower level indicate a cultural zone closer to the contemporary period. Bricks from older houses were used again and again. Clear indications of a progressive degeneration is evident most glaringly in Mohenjodaro. All this was due to the calamitous alteration in the course of the Indus and the Ravi rivers. This led to the countrywide desecration of the surrounding. The city of Mohenjodaro became weak under the pressure of increased population. Over the years there was an influx of refugees into the Indus cities. They were said to have been followed by the Kulli culture and city must have suffered on account of this influx. During the declining phase of civilization at Mohenjodaro, rooms were divided into smaller ones, mansions became tenements. The street plan was no longer maintained. Evidently, the city was overpopulated and law and order collapsed. All these were indicative of a gradual decline.

The comment of Mortimer Wheeler is worth mentioning here, although his hypothesis for decline of Harappan civilization in terms of 'Aryan invasion' is questionable. He says – 'Impoverishment of the surrounding farmlands by over-cultivation, by destruction or neglect of irrigation channels, by over-grazing, has been postulated. The untiring consumption of major vegetation implied by the firing, age after age, of millions of bricks may, even with the aid of hill-timbers, have helped to bare the land and may possibly, to small extent, have reduced the transpiration of moisture. Mohenjodaro was steadily wearing out its landscape' (Wheeler, 1979, 127). Scholars like Nayanjot Lahiri argue that 'the rivers which nurtured the Harappans also weakened into fatal devastation' (Lahiri, 2000, 13). Mackay, John Marshall and S.R. Rao have also explained the devastation caused by rivers like Indus. Similarly, M.R. Sahni has also shown as to how upliftment of land due to earthquake in the Indus region led to damming of Indus river and this caused rise in water level and consequent submergence of areas for a longer period of time. To the east of Sind, urban collapse may have been caused by 'insufficient river water' (Lahiri, 2000, 15). There is also an opinion among the environmental historians that decreasing fertility was the reason which was caused by increasing salinity of the soil. This probably took recourse because of the expansion of the desert of the neighbouring area. Historians such as Robert Raikes, George Dales and M.R. Sahni point towards a sudden uplift of the land which caused floods. Excavations reveal that Mohenjodaro itself was flooded more than once. Traces of at least three main phases of deep flooding can be detected here. Chanhudaro was also twice-destroyed by 'massive' inundations. The devastating floods were caused by geomorphologic changes in the lower Indus

region and obstructed the normal process of irrigation, leading in turn to the economic decline of some of the Harappan settlements. Rafique Mughal has shown the reduction in the number of sites that post-date the mature Harappan phase, which according to him, occurred due to 'major hydrological changes around 2100 BC' (Mughal, 1993, 93).

There was certainly decline in material prosperity and civic standards of the cities of Harappan civilization. But V.N. Mishra says that this decline did not lead to a decrease in the population. It only forced the population to migrate from the lower Indus valley into Saurashtra and from the Hakra-Ghaggar valley into north Punjab, Haryana, and the upper Yamuna-Ganga doab. The sudden proliferation of late Harappan sites in Saurashtra, north-east Punjab and Haryana and the upper Yamuna-Ganga doab attests to this migration. At least in the case of north Punjab and the upper Yamuna-Ganga doab, rainfall is not significantly higher than in the adjoining parts of Punjab and Haryana which had witnessed dense human settlements during the early and mature Harappan times. Therefore, these new regions of colonization could not have conferred any significant advantages to the immigrants. On the other hand, the shift of the courses of the Yamuna and Sutlej to the east and west, respectively, would have considerably reduced the availability of both surface and sub-surface water in the Ghaggar valley. This would, in due course, have adversely affected both natural vegetation and agriculture and forced the population to shift to areas like north Punjab (Sutlej channel) and the upper Yamuna-Ganga doab, where the rivers provided the ecological conditions the Harappans had long been accustomed to exploit.

In 1931, Sir Aurel Stein and Sir John Marshall, on the basis of their evaluation of the multiple archaeological evidence from Baluchistan and Sind, came out with the interpretation that climatic change was one of the prime reasons for the decline of Harappan civilization. They proposed that climate in these regions during the Harappan Civilization period was more wet than it is at present. This theory was supported by archaeologists like Stuart Piggott and Mortimer Wheeler as well. In the 1950s, American archaeologists like Fairservis came up with the anthropological approach to understanding the decline of the civilization. He looked at cultural evolution in terms of cultural processes in contrast to the earlier approach which laid more emphasis on events like climate change. Robert L. Raikes and Robert H. Dyson in 1961 critically examined various kinds of evidence deduced by Aurel Stein and John Marshall in support of their climatic theory. They concluded that the theory of a more wet climate could not be accepted as conclusive fact. Walter A. Fairservis, Jr. also argued similarly. In 1971, Gurdip Singh reemphasized on the theory of a wet climate, but his arguments was somewhat different from Aurel Stein and John Marshall. He has suggested a connection between the onset of the drier

climate and the decline of the Harappan civilization. His evidence for climatic change was rather based on palynological not on archaeological data. He believed that the climatic change and the resultant fluctuations in rainfall covered almost the entire Holocene in north-west India and not just the Harappan period. Gurdip Singh's evidence for a wetter climate during the Harappan period has been questioned by scholars. According to V.N. Mishra, if increased rainfall was a causative factor in the emergence of agriculture, in the expansion of farming-based life, and in the development of Harappan sites in the relatively congenial west Rajasthan and north Gujarat plains than in the hyper-arid Cholistan (Mishra, 2008). But the archaeological evidence is quite contrary to Singh's hypothesis. Therefore, it is now being established that wetter climate was not a decisive factor in the rise and growth of the Harappan culture. Further, it is also to be seen that the most dense distribution of Harappan sites is not on the Indus river and its tributaries as understood earlier, but on now extinct Hakra-Ghaggar and its tributaries. Out of nearly 800 Harappan sites, more than 530 sites are located on the Hakra-Ghaggar system and less than a 100 sites are left in the proper Indus valley. V.N. Mishra argues that since the Harappan culture is essentially a culture of the Hakra-Ghaggar valley, any search for the decline of this culture must hold an investigation into the fluctuations of the fortunes of this river. Some more theories are shown in the following table, put forward by different scholars on the basis of archaeological evidences:

Theories of Decline

1. Flood and earthquake: (Raikes, Sahni, Dales)
 - A. Flood: Silt deposits above ground level houses built on silt covered debris.
 - B. Earthquake: Indus area is earthquake-prone zone (M.R. Mughal) Earthquake raised the level of flood plains blocking the passage of rivers' water to sea, causing flood in cities; Earthquake caused shifting of land away from sea-coast affecting commercialities.
2. Shifting of Indus (destroyed Mahenjodaro): (Lambrick) Silt is sandy; Sand silt is not due to floods.
3. Increasing aridity: (Agrawal, Sood) 2nd mill BC a period of increased arid conditions; Decline of agriculture; Drying up of Ghaggar.
4. Aryan Invasion: (Wheeler) Human skeletons lying in the streets; Rigveda refers to Fortress of Dasas which God Purandara destroyed.

5. Onset of Drier Climate : (Gurdip Singh)
6. Ecological Imbalance: (Fairservis) Population increase, growth in city (land and forest decreased); Soil exhaustion in the area with forests disappearing, there were more floods and droughts; Townsman moved to Gujarat region and eastern area.

It is well established now that a highly developed civilization like Harappa eventually declined due to environmental reasons.

The scholars working on the Harappan civilization not only look for the causes of its decline, but off late have also been researching on the continuity of the culture even if the civilization declined. Archaeologically, all that seems to have happened was that some of the sites were abandoned and the tradition of literacy, seals and sealing were lost. It simply meant the end of the urban phase but many smaller sites continued to exist. The archaeological finds show a stylistic continuity from the Harappan phase. In fact, in the areas of Rajasthan, Haryana and Gujarat vibrant agriculture communities emerged in larger numbers in the succeeding periods. Thus, from a regional perspective the period succeeding the urban phase can be treated as one of the flourishing agricultural communities. That is why scholars now talk about cultural change, regional migration and modification of integrated system of settlements and subsistence.

DEFORESTATION IN ANCIENT INDIA

Historians believe that the beginning of deforestation began as early as the Vedic age when the Aryans settled into the doab region. The Aryans came to India as semi-nomadic people with mixed pastoral and agricultural economy, in which cattle-rearing played the main role. Cattle formed their most-valued possession and the chief form of their wealth. Though cattle-breeding seems to have been the chief occupation of early Aryans, they also practised agriculture. Unlike the Harappans, who dug their fields themselves, the Rigvedic Aryans cultivated land by means of the plough drawn by oxen. Ploughshare is mentioned in the earliest part of the Rigveda, though some consider it an interpolation. Possibly the ploughshare was made of wood. Early Aryans also possessed some knowledge of the seasons which promoted agriculture. There is evidence to show that the Aryans used fire for burning the forests and making the land fit for cultivation. However, wood being a material basic to Aryan life, cutting rather than burning forests was probably a more usual means of clearing the land. References to ploughing, sowing, reaping, threshing and winnowing occur in the later portions of the Rigveda. Agrarian economy, therefore, became more stable towards the end of the early Vedic period.

The Aryans and Their Settlement Pattern

The extent of the geographical knowledge of the Aryans at the time of the Rigveda can be ascertained by reference in the hymns to various rivers. From this it would appear that the early Aryans lived in the geographical area covered by eastern Afghanistan, Punjab and fringes of Western U.P. In the text, the western tributaries of the Indus, the Gomati (modern Gomal), the Krumu (modern Kurram) and the Kubha (modern Kabul) are mentioned. The Suvastu (Swat) is the most important river mentioned to the north of Kabul. But the main focus of the Rigvedic culture seems to have been the Punjab and Delhi region. Here, the most frequently mentioned rivers are the Sindhu, the Saraswati, now lost in the Rajasthan sands, the area probably represented now by the Ghagghar river, and the five streams which collectively gave their name to the Punjab. These five rivers are Shutudri (Sutluj), Vipas (Beas), Parushni (Ravi), Asikni (Chenab) and Vitasta (Jhelum). The Sindhu, identical with the Indus, is the river par excellence for the Aryans and is repeatedly mentioned in the texts. The geographical knowledge of the early Aryans did not extend beyond the Yamuna, which is thrice mentioned in the Rigveda. Ganga is mentioned only once in a late hymn. Thus, the focus of the Aryan culture during Rigvedic times was between the region of Yamuna and Sutluj and along the upper course of the river Saraswati. The Vedic poets knew Himalaya as the only mountain and did not mention Vindhya. Mujawant, one of the Himalayan peaks is referred to in the Rigveda as the source of Soma.

The later Vedic literatures shows that the Aryans, during the later Vedic period pressed further eastwards and expanded from Punjab to the whole of Western U.P., covered by the Ganga-Yamuna doab. They set up kingdoms in Kosala, to the east of the Doab and in Kasi region of Varanasi. The Bharatas and the Purus, the two major tribes were combined and thus was formed the Kuru clan. In the beginning they lived between the Saraswati and the Drishadwati, just on the fringe of the doab. Soon the Kurus occupied Delhi and the upper portion of the doab, the area called Kurukshetra or the land of the Kurus. Gradually they localised with the Panchalas, who occupied the middle portion of the doab. The Kuru-Panchala people extended their authority over Delhi and the upper and middle parts of the doab. They set up their capital at Hastinapur in Meerut district. History of Kuru is important due to their role in Mahabharata war. Excavations at Hastinapur (900-500 BC) have revealed settlements and beginnings of town life. But they do not give the description of Hastinapur in Mahabharata.

Towards the end of the later Vedic period, around 600 BC, the Vedic people spread from the doab further east to Kosala in eastern U.P. and Videha in northern Bihar. Although Kosala is associated with the story of Rama, he is not mentioned in Vedic literature. Videha was to the east of the river Gandak and north of the

Ganga. Janak, the king of Videha and the traditional father-in-law of Lord Rama is mentioned more than once in the Vedic texts. South of the Videha, on the right bank of the Ganga was the region known as Magadha. It was not wholly Aryanized but was a land of nomadic people who did not follow the Vedic rites. To the east of Magadha, on the borders of modern Bengal was the small kingdom of Anga. Bengal and Assam were still outside the pale of the Aryan civilization.

The Gangetic Valley became an important centre of urban civilization from about 1000 BC. With the introduction of iron, we find increasing number of settlements in the Ganga-Yamuna doab. Archaeologically, the early iron age settlement is associated with a fine, well-fired pottery, called Painted Grey Ware (PGW) now found at Kurukshetra, Indraprastha, Hastinapur, Kausambi, Rajagriha, etc. Another pottery, Northern Black Polished Ware (NBPW), dated to around 500 BC was also associated with the cities of the Gangetic valley. These two phases of Iron Age culture (1000-500 BC) were associated with the eastward movement of the Aryans from the earlier abode of the Indus Valley to the Ganga-Yamuna valley.

In *Satpatha Brahmana*, there are references to eastern and western oceans, which may have been the Arabian Sea and the Bay of Bengal. We also have references of forests and deserts. The later Vedic texts refer to a threefold division of land as also a five fold division of the country. The three broad divisions are: Brahnavarta or Aryavarta, Madhyadesa and Dakshinapatha. The *Aitereya Brahmana* refers to a fivefold division: 1. *Madhyadesa* (middle country) 2. *Prachides* (eastern quarter) 3. *Dakhinades* (southern quarter) 4. *Pratichides* (western quarter) and 5. *Vdichides* (northern quarter). The middle country was the centre of the Aryan world extending from Shravasti to the Gangetic doab and was occupied chiefly by the Kurus and Panchalas. It is thus seen that the main line of Aryan thrust was along the Himalayan foothills, north of the Ganga. Area south of the Ganga received little attention in the later Vedic texts.

Advent of Iron

Advent of iron in the later Vedic period revolutionised the economy from around 1000 BC. Iron was used in Gandhara area in Pakistan. Iron implements buried with dead bodies have been discovered. At about the same time, use of iron appeared in eastern Punjab, Western U.P. and Rajasthan. Excavations show that the use of iron weapons started in Western U.P. in about 800 BC. The iron ore may have been used to clear the forests in the upper gangetic basin, although forests may not have been so thick. Towards the end of the Vedic period, knowledge of iron spread to Eastern U.P. and Videha. Iron was called *Syama* or *Krishna ayas* in the later Vedic

texts. Because of the availability of iron tools, agriculture became the chief source of livelihood of the later Vedic people. Later Vedic texts refer to six, twelve and twenty-four oxen yoked to the plough. Ploughing was done with wooden ploughshare, which was effective in light soil of upper Gangetic basin. Enough bullocks could not be available because of cattle slaughter in sacrifices. Thus, agriculture was primitive, still it was widely prevalent.

The *Satapatha Brahmana* devotes a full section to rituals connected with ploughing and enumerates various agricultural operations. The *Atharva Veda* gives a ritual for leading river water into new channels. It also speaks of spells to avoid drought and excess of rain. According to ancient legend Janak, the king of Videha and father of Sita lent his hand to the plough. Idea of private possession of land began to crystallize. To begin with, land was owned in common by the village, but with the decline of tribal units, land was divided between the families in the village and thus the concept of private property came into being, bringing with it the related problems of ownership, land disputes, and inheritance. The later Vedic people continued to produce barley, but during this period, rice and wheat became their chief crops. Wheat became the staple food of the people in Punjab and Western U.P. for the first time. Vedic people became acquainted with rice in doab. It is called *vrihi* in Vedic texts and its remains have been discovered from Hastinapura (800 BC). The use of rice is recommended in rituals. Beans and sesamum were also known and various kind of lentils were also produced.

The growing importance of agriculture undermined the pastoral economy which may not have been able to feed the increasing population well enough. Still cattle-rearing remained their occupation. In the hymns, desire was frequently expressed for increase in cattle, which still constituted the principal form of movable property. The buffalo, in addition to the cattle, seemed to have been used for agriculture during this period. Simultaneously, with the transition from pastoral to agricultural economy, several new forms of arts and crafts arose. In place of few occupations in the *Rigveda*, many are enumerated in the later Vedic literature.

The transition from the use of stone to metal was slow and gradual. People learnt to use copper, gold, silver and finally iron. In the beginning, people were fond of gold and then started the trend of copper and bronze which are hard and also shiny. In Europe, the Neolithic age was followed by the Bronze Age but in India there was no Bronze Age as such. In North India, people switched to copper from stones for making axes, spear heads and other objects. In India, the use of bronze started in the Copper Age, so we generally call this intermediate age as the Copper and Bronze Age. The use of iron started much later which marked the beginning of Iron Age in India. Thus, Metal Age in India can be divided into (i) the Copper and Bronze Age, and (ii) the Iron Age. Interestingly, there was no intermediate

Copper and/or Bronze Age between the Neolithic and Iron Ages in the southern parts of India.

Why did Copper and Bronze come into use earlier than iron?

It is a historical truth that iron as a metal is more democratically distributed throughout the world, whereas copper and tin (combination of the two make bronze) are sparsely located at few places. But despite this fact, iron came into use much later. This was largely because the technology of regulating fire and heat (called Pyrotechnology) was at its nascent stage. The melting point of copper is 1100°C, whereas for extracting iron, the ore should ideally be heated to over 1500°C. Apart from attaining and controlling high temperatures in furnaces, iron-making involves a number of complicated steps called carburization and tempering. Carburization is a method wherein iron is brought in contact with carbon while it is hot and then it undergoes physical changes to become steel. Tempering refers to fast cooling of the iron which has absorbed carbon. The two methods enable iron to acquire hardness and strength and this renders it a superior metal for manufacturing tools and weapons. Therefore, immediately after getting this knowledge of making iron, iron axes and iron ploughs were made and they proved to be more efficient.

The role of iron was not so significant in the later Vedic phase as was after sixth century BC, i.e. post-vedic period. The introduction of iron was seen in 900 BC but its agricultural and industrial role was almost negligible at that time. During the post-Vedic period, we see remarkable development in the field of agriculture, as has been indicated in the *Astadhyayi* of Panini – the contemporary literary source. During this period, many crops including cereals, oil seeds, pulses, etc., and vegetable were introduced. The most important development was the introduction of wet rice cultivation or paddy transplantation. This development gave a great boost to the development of other economic activities. R. Thapar and R.S. Sharma attribute these changes to the introduction of iron. It was iron that helped in the clearing of tropical jungle of the middle Ganga-basin for cultivation as well as settlement.

From 600 BC we came across many iron tools at different places, like Vaishali and Rajgriha. However, N. Ranjan Ray and D.K. Chakravarti opine that iron did not play an important role in the transformation of middle Gangetic basin. N.R. Ray says that some hard-wood was used as ploughshare. They substantiate their view by saying that no iron ploughshare or saw was unearthed belonging to this period. D.K. Chakravarti points out that much material development had taken place before 3rd century BC. R.S. Sharma has refuted the view on few assumptions. He

argues that excavations till this time have been made only in the urban areas. Agricultural instruments can be found in the rural areas. Cultivation of sugarcane, paddy and mustard was impossible without deeply digging the land and it could be taken place only with the iron instruments. The warm humid and acidic soil of this region might have corroded these iron objects into brown powder. The literary sources refer to some iron objects, like ploughshare of iron. Evidence of silver in 5th century BC also pays stress on the use of iron in that period because silver could not be cut into pieces without iron. Thus, on the basis of all these evidences and the contention of R.S. Sharma and Romila Thapar, it seems that iron played a prominent role in the post-Vedic period. It was iron which helped in agriculture production so much that it could feed surplus. People were engaged in various other works too. The craftsmen started to make better goods. Carpenters and blacksmiths became more important. Thus, specialization in the society was started and iron goods, wheel, etc., were produced. Romila Thapar's hypothesis is further substantiated by many references to traders, trading activities as well as minting of coins. Further evidences reveal the process of different stages of transformation of a rural culture into an urban economy.

The smelting of iron may have begun with using a technology parallel to that of copper-smelting, but gradually use of iron dominated the scene. Higher temperatures became possible as excavation at Jodhpur in northern Rajasthan has revealed the use of furnaces for smelting and forging ore. Other centres of iron production were Atranjikhra and Khairadih in the western Ganges Plain. Efficiency in handling iron was a new experience, given that the Chalcolithic cultures of the Gangetic Plains do not suggest the extensive use of metal. Judging by the artifacts at sites in many parts of India from this time, it would seem that various societies were experimenting with new technologies facilitating the use of iron. It has also been argued that there are references in the earlier sections of the *Mahabharata* to the quenching of iron and use of molten metal for casting.

Did Iron Play Any Role in Deforestation?

Iron axes facilitated the clearing of forests so that land could be used for cultivations. The iron hoe was an effective-agricultural implement, and the invention of the iron ploughshare was more efficient in a heavy soil as it could plough deeper than wooden ploughshare. However, very few iron axes have appeared in excavations. Textual evidence seems to prefer burning of forests as a method of clearing. Iron ploughshares were rarely found from excavated sites. Further, the efficiency of an iron ploughshare in soils, other than that of the Ganges Plain has been questioned. On this basis many scholars believe that iron may not have any role in deforestation.

Iron implements brought many technical changes in various craft activities. There could have been an increase and qualitative improvement in the making of items from bone, glass, ivory, beads of semi-precious stones and shell, and stone objects, as compared to earlier Chalcolithic levels. This suggests an increase in confidence in using the new technology and using it more extensively. For example, in various construction activities in wood, from making the beams for ceilings to improving the structure of the chariot and cart. Thus iron might have played an indirect role in the loss of wood. Although iron may not have been the crucial variable as a single technological input, but 'its role in a package of changes' cannot be minimized. Since control over the surplus was in the hands of a few, the role of iron in enhancing the surplus became a significant factor.

Historians like R.S. Sharma and Romila Thapar argue that urbanization was possible only because of the widespread use of advanced iron tools that helped people in clearing the dense monsoon forest of the Gangetic plains. Widespread use of iron tools was possible only when Bihar ore mines were exploited. Makkhan Lal argues that the so-called extensive use of iron tools and the large scale forest clearing for human settlements and agricultural land is a myth. He says that the problem of clearing the forests for human settlement and agricultural land, and a few references found in literature, like, *Satapatha Brahmana*, have been blown out of proportion. The vast alluvial plains of northern India, as we see them today, are the result of continuous deforestation for the last four millennia. In the traditional literature, we have ample evidence of the Gangetic plain covered with dense forests. The *Satapatha Brahman* mentions that area between Saraswati and Sadanira (modern Gandak) river was a dense forest and Aryanisation of this area was possible only after burning of the forests. According to the *Mahabharata*, Hastinapur, the Capital of Kurus was situated in a forested area. It also mentions that the kingdoms of Kurus and Panchalas covering roughly the upper Gangetic plains were located in forested area. Makkhan Lal says that the major damage to the forests was done by the railways which obtained their fuel supply directly from local timber until a century ago. The intensive colonization and large scale deforestation has brought the balance between man and vegetation to a very delicate stage.

R.S. Sharma's argument that there have been fundamental changes in iron technology and tool typology from PGW to NBPW period and it was after the opening of Bihar ore mines that the iron tools became extensively used was never supported by any concrete evidence. To Makkhan Lal, the upper Ganga plains did not have to look towards Bihar ore mines which were opened as late as fifth-sixth centuries BC, for the extensive use of iron tools and implements. The presence of

iron objects in such profusion and the discovery of furnaces at Atranjikhhera and Noh and use of certain specific tools blacksmiths at Atranjikhhera make it very clear that not only iron tools and other objects were manufactured here but the smelting of ore was also done. The main source of iron ore was perhaps the region extending between Agra and Gwalior. The hills of this region are extremely rich in iron ore and the iron content is very high. Makkhan Lal opines that the role of Bihar iron ore mines in urbanization does not stand the scrutiny of evidence. Makkhan Lal concludes that thick forest cover in the Ganga plains was protected as late as sixteenth and seventeenth centuries and it would be erroneous to believe that large-scale forest clearing was done in the middle of the first millennium BC. There was no fundamental change in iron tool typology and technology and these were neither extensively used as forest clearing tools from later Vedic to post-Vedic period. He says that the new types of iron tools that were introduced in the post-Vedic period were produced in the mid and late phase when the urbanization was already an established fact. To him, there was no need for the large-scale forest clearings in any period. Whatever little forest clearing was needed could be done with technology available to the later Vedic people.

COMMUNITY AND RESOURCES IN PRE-COLONIAL INDIA

One of the important issues related to environmental history today is the concern for sustainable development. Many scholars believe that pre-modern regimes were the most prudent and balanced resource users and the indigenous knowledge of local communities is the most effective method of sustainable development. Till the time there was little state intervention in the management of natural resources, the steadiness and dependability on traditional method of land-use was not disturbed resulting into any frequent man-made crisis. The debate on the role of humans in environmental degradation and change in land-use pattern began with the hypothesis of scholars such as Garrett Hardin who believed that the 'tragedy of the commons' is due to their own activity. To prove his point, he presented the case of herdsmen who added additional animals even though their common pasture was overgrazed as a result. The solution to this problem, according to him, is in strong state control and establishment of firm and well defined property rights. Beryl Crowe was critical of this solution and believed that there are limits to state control and there is a possibility of its misdirection by special interest groups. In India and various other south-east Asian countries, it is generally proposed that before the onslaught of the colonial rule, the state intervention in managing the natural resources was insignificant. The interventionist attitude of the state has been attributed to the colonial rule, when the state tried to control and manage the natural

resources to enhance its revenue collection. It was a marked departure from the earlier practice when the state intervened and controlled for conservation. Madhav Gadgil and Ramchandra Guha believed that there was relative stability in the interaction between man and nature in the pre-colonial period and the colonial rule led to grave dislocation. Richard Grove has contested this hypothesis of a 'purely destructive environmental imperialism'.

Ravi Rajan goes to the extent of calling the Colonial Government policy of resource management as based on scientific forestry. Sumit Guha does agree that the earlier practices cannot be characterised as unsuccessful, but he believes that indigenous people and local communities were unable to provide optimal solutions. D. Ghai, J. Vivian and Vandana Shiva, however, contest that local communities developed complex and indigenous systems of institutions and rules regulating the ownership and use of natural resources. Local knowledge and technologies built up over time and hardened down from one generation to another have ensured the continued functioning of these systems of resource management. India has suffered serious environmental problems in the last 30 or 40 years. Forests have shrunk, wildlife is vanishing, and the air and water have become dense with dangerous pollutants. Environmentalists believe that the problems arose because of the new political and economic structure that followed the Industrial Revolution. Others think that traditional societies in Asia had never experienced such problems and so the answer was to restore the practises that existed before the era of western colonial rule. Vandana Shiva argues that 'for centuries, vital natural resources like land, water and forests had been controlled and used collectively by village communities, thus ensuring a sustainable use of these renewable resources. Colonial domination systematically transformed the common vital resources into commodities for generating profits and the growth of revenues'. Wild life also suffered in the colonial period. We shall be dealing with this aspect in detail in Chapter 3. But before that let us try to find out if there was any loss to wild life during pre-colonial period.

Hunting under Mughals

Immediately before the British colonial rule in India, the Mughals largely dominated the rulership. They like any other medieval kings were fond of hunting wild animals. Hunting under the Mughal empire was a pleasure sport, but unlike the later colonial British rule, lion hunting in particular, did not take place indiscriminately. The description given in the Persian records and the Mughal paintings verify the existence of a large lion population during the Mughal rule. Babur had laid the foundation of the Mughal empire in India. He was very much attracted by the natural environment of this place which he described as Hindustan. The animals and birds that he encountered caught his attention which he had not known in his own homeland in Central Asia. Divyabhanusinh mentions that Babar, however, did not

mention the wild cat, lion and records very little about killing a tiger. Probably, Babur was familiar with lion and tiger as they were not peculiar to Hindustan. One of the favourite methods of hunting was the *Qamargha*, says Divyabhanusinh, in which emperor's army used to encircle the animal and facilitated the king and his close nobles to hunt from horseback. Akbar maintained an account of the game he had shot. The records and paintings suggest that lions take pride of their place. Their descriptions in court chronicles testify to the lion's central position in Mughal hunts. There are two instances of Akbar hunting lions which have been recorded in the *Akbarnama*. In 1562, he is said to have gone on lion hunting near Mathura. Another lion hunting incident mentioned in the Persian documents took place in the Mewar region near Alwar in Rajasthan. In the *Ain-i-Akbari*, Abul Fazl records two more instances of hunting by Akbar. There is, however, only one painting of Akbar which depicts him hunting a lion. Jahangir was very fond of hunting animals and did it meticulously. He records that 'in a span of 39 years, as many as 28,532 animals and birds were hunted in his presence of which he himself killed 17,167'. Thus, the Mughal emperors enjoyed hunting, but it was confined to the ruler and his very close nobles. Hunting for them was only an animal affair and so the population of the lions did not undergo a negative turn. In just 100 years after the decline of the Mughal empire, lions' population in India came down drastically. Ramchandra Guha blames it on the expanding human habitation and encroachment into the jungle. The human population grew from 116 million in 1600 to 159 million in 1800. But there were other reasons as well and one of the prime basis was created by the large-scale killing of lions by the British officials. According to Divyabhanusinh, a single British officer is reported to have shot as many as 300 lions. It may be reiterated here that Jahangir with all his passion for the hunt and the imperial resources at his command had shot only 86 lions in a span of 39 years.

Mahesh Rangarajan in *India's Wildlife History* argues that 'two clear watersheds mark the past: one was the impact of the British, whose intrusions into the world of the wild were far more extensive than those of their predecessors. The other was the unleashing of widespread destructive forces, including the state-sponsored slaughter of certain wild animals and the harnessing of the forest for industrial raw material and military supplies.' In fact, the creation of legal and governmental apparatus to administer large stretches of forests by the British proved disastrous for the wild animals.

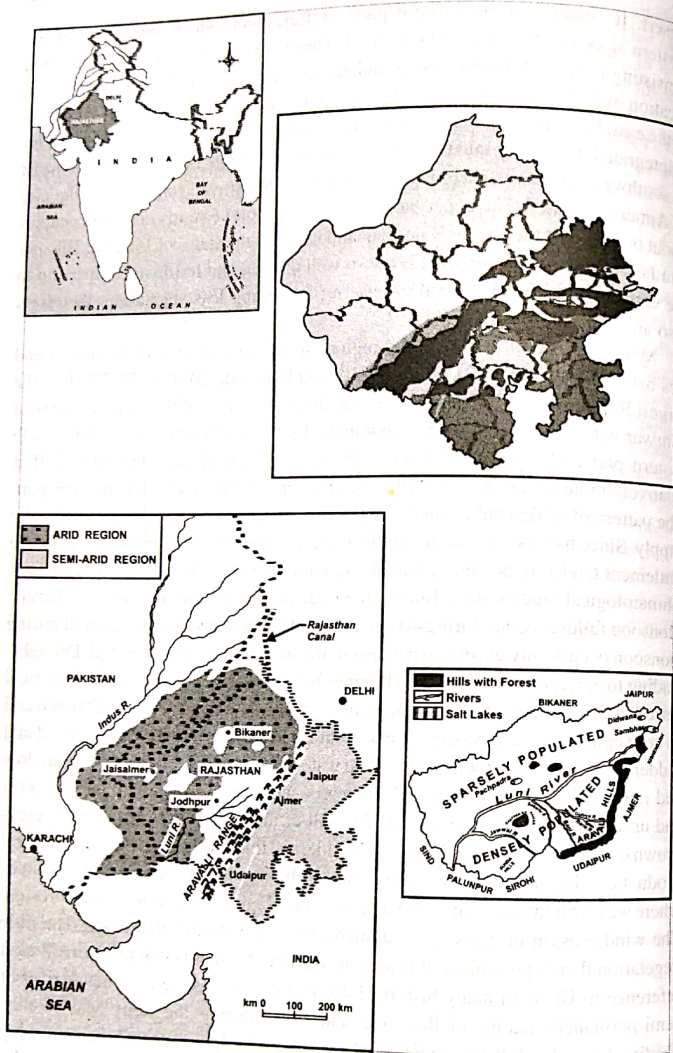
Ecology, Prudent Tradition and Land-Use Change: Case of Rajasthan

Ecology

You will be surprised to know that most of the deserts in the world are located on the western side of the large continental land masses. So is the case with the Thar

Desert. It makes up the western parts of Rajasthan, which spreads from the western slopes of the Aravali up to Sind. These areas have very little vegetation consisting mainly of thorny bushes and are sparsely populated. The geographical location of Rajasthan is between 23°3' to 30°12' in the north and 67°30' to 78°18' in the east. Roughly, the shape of Rajasthan is like irregular rhombus. The territory is integrated diagonally into two parts by the Aravali range running from northeast to southwest. However, there is a little break in the Aravali range where the city of Ajmer is situated. The upper part or the Western part (we may call it) occupies about two third of the area of Rajasthan and includes the states of Jodhpur, Bikaner and Jaisalmer. This western part is not so well drained and fertile in comparison to the eastern part. The areas in the western part having less vegetation, therefore, also are sparsely populated (Map 2.2).

Marwar is one of the important regions in the western part of Rajasthan and lies between the latitude 24°36' to 27°40' and longitude 20°4' to 75°23'. It is the largest Rajput state of Rajasthan. Physical diversity is one of the many features of Marwar with a basic contrast in geographical set-up of the western and the south eastern parts. The western portion is purely a desert whereas the other half is relatively more fertile. R.C. Sharma uses the term 'little desert' for the later part. The pattern of settlement in such area, largely depended on the character of water supply. Since the eastern and the southeastern portions have higher water-table, the settlement tended to be denser than the remaining parts where it was much lower. Climatological studies have found abnormal rainfall in this region as common. Monsoon failures occur during 40 per cent of the years, and normal rainfall during monsoon occurs only during 26 per cent of the weeks when it is expected. Droughts leading to agricultural failures and famines have occurred throughout the historical period of this settlement. The annual rainfall averages from 250 mm to 350 mm and so crop cultivation in this part is carried out for subsistence production of food and fodder along with livestock rearing. The water tables in Western Rajasthan are low and range from 60 to more than 100 meters and ground water is saline, brackish and unfit for drinking or irrigation. The soil of this region is light-textured, grey-brown desert soil, which is alkaline and saline, and thus, is not suitable to agricultural production. The soil is sandy in majority of the region except near water sources where we find light alluvium soil. Such soil type is highly susceptible to wind erosion. The wind erosion in many areas destroys the newly germinated crops. The little vegetation that is possible in this area throughout the year is that of *khejri*. We get reference to *khejri* in many historical documents. Luni is the only major river of semi-permanent nature in this area and flows during the rainy season only. Traditionally, the Rathors have been the rulers of Jodhpur state and their rulership was based on the practice of *bhai-bant*. Under it, the sons and brothers of the ruler



MAP 2.2 Ecology of Rajasthan

used to occupy various territories won over by them and these territories were termed as *thikanas*. These *thikanedars* had a kind of political and normal obligation to provide military service to the state.

Famine was one of the recurring features of Marwar. Traditionally, the people of Rajasthan divided the famines into four categories depending on its severity – *Annakal* (grain famine), *Jalakal* (scarcity of water), *Trinkal* (scarcity of fodder) and *Trikal* (scarcity of grain, water and fodder). The available archival data show that the frequency of famines increased during the nineteenth century. It was a period of great political instability, uncertainty and economic dislocation in Marwar. The state lost its earlier control of distribution of resources, largely the food. The economic exploitation increased under the tottering Rathor states and the new British colonial rule. The people of Marwar, in order to cope with the adverse climatic and environmental conditions, evolved their own mechanism and traditions. The staple food of the people in general was *bajra* (pearl millet). They also allowed *bordi* plants and *khejri* to grow along with *bajra*. *Khejri*, not only provided livestock feed, but its fallen leaves on the ground added fertility to the soil. Although agriculture was their primary means of survival, but they also raised livestock as subsidiary occupation and allowed shrubs and trees to grow along with the cultivated crops. The size of lands held with individual households was scattered and this provided them surety for getting some harvest from some plots in the situation of erratic nature of rainfall. This system had an inbuilt system of leaving the lands to fallow for 3-4 years after 3-4 years of its cultivation. This helped in the land regaining its fertility. The fallow lands also provided grazing resources for the livestock, which provided manure to these fields and further facilitated in regaining the fertility of the land. In order to effectively use the ecosystem and for making optimum use of the available grass and shrubs, a mix of animals like cattle, camel and goats were bred. The livestock breeders moved their livestock to the relatively humid eastern part in winters and used to come back before the onset of the monsoon. One of the pastoral communities of this region which is still continuing with this tradition of migration to distant lands for 9 to 10 months of the year is that of the Raikas or Rabaris (Singh, 2011b).

Prudent Tradition

We have evidence of various indigenous methods of water conservation prevalent in pre-colonial period, some of which are even used today. Earlier the most important method of water appropriation was the wells. But the decline in the water table over the years necessitated the introduction of water lifting devices. These devices differed according to the topography and the depth of the water table of

different regions. The archival records of medieval period suggest that the state was very much concerned about irrigation system and took all necessary steps to ensure good agricultural production every year. There are also evidences of the state providing support for the maintenance of the wells. Apart from the wells, there were other methods of rainwater harvesting in practice. Almost all the villages used to have *tobas* (ponds), tanks and wells where the water got accumulated during monsoon. Since the water table of the wells used to be very low, the Persian wheels were used to lift water in leather pitchers from wells. Irfan Habib has shown how did the diffusion of the elements of new technology in the thirteenth and fourteenth centuries come from 'a violent external factor' of the Turks. The Turkish rulers, nobles and soldiers 'all came with demand for goods and services they were used to in their homelands, and so caused an emigration of the arts and crafts of the Islamic world to India'.

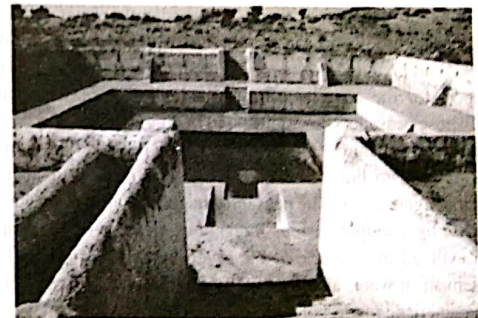
One of the first areas which underwent major technological changes after the Turkish rule was the agriculture in general and irrigation in particular. The Turks brought with them the Persian wheel which began to be used for pulling out water from deep wells for irrigating the fields. There were many sources of water for the purpose of irrigating fields in early medieval times. Rain water was the natural source and ponds and tanks received this water which was used for irrigation. The most important controlled source has been the water of the wells, especially in North India. Almost all the irrigational devices were oriented towards drawing water from the wells. B.L. Bhadani (1999) mentions that the pattern of settlement depended largely on the character of water supply in Rajasthan. In fact, if we look at the map of India most of the villages and township were located around water available areas. In states like Gujarat and Rajasthan, where water was not available in abundance, people developed mechanisms to store rain water. Because of the erratic nature of the rain fall, people used to tap water through artificial methods of irrigation. People had evolved numerous indigenous methods to overcome this constraint. There were different methods of water harvesting for irrigation purposes like *Khareen*, *Rela*, *Sewanj*, *Bahlo*, etc. (Kumar, 2008). These systems were evolved to store rain water by directing it to the fields and managed run-off rainwater. Peasants used to bring water from large catchment area and diverted rainwater to the fields for irrigation purposes.

Another unique, but popular, construction in Rajasthan and Gujarat are the step wells known as *baoli*. These medieval step wells are still in existence in many parts of Gujarat and Rajasthan in cities like Ahmedabad, Jodhpur and Jaipur. One such step well is also located near Jantar Mantar in Delhi. Huge amount of water was channelised to the step wells through water channels and then people of the

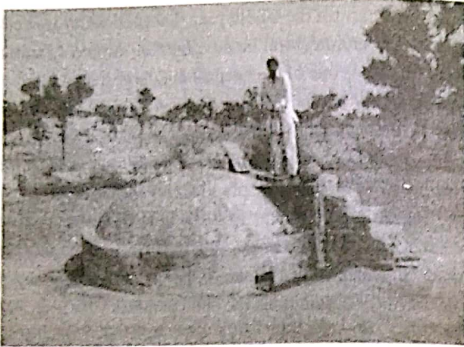
surrounding region used it for the whole year. The step wells are very gigantic and impressive in terms of architectural beauty. One of the most famous step well is Chand Baoli in Jaipur. It is one of the deepest and largest step wells in India. It was built in the ninth century and is 100 feet deep with 3500 steps.

Beri is another unique construction of Rajasthan. They were constructed near a water body. Its construction looked like a pond built to extract and trap the water from adjoining areas. It is being in practices even today in western Rajasthan because in this region ground water level is very low and also there is limited possibility of retention of water in the ponds for a longer period of time. Low retention of water in water bodies is due to the excessive heat and dry weather in the region as the rate of evaporation in the open ponds is very high. A *Beri*, however, does not let the water evaporate so quickly.

Another important method of water conservation was *Kundi* or *Kund* (Water Tank) found in many old settlements and villages of western India, particularly Gujarat and Rajasthan. It is a mechanism based on the direct accumulation of rain water and is primarily used for drinking purposes ever since medieval times. *Kunds* catered to both the domestic and public need of water. Many a time huge catchment areas were created to collect rain water and channelise it down to a big tank below the earth's surface in many cases, the roof of the house was used as catchment area to collect rain water. Before the onset of rains, the roof was cleaned and washed with the first rain and subsequent rains were allowed to be channelised to the underground water tank. The underground tanks functioned as reservoirs and



PHOTOGRAPH 2.1 Catchment Area of a man-made pond in Rajasthan. There were Channels made to collect water and steps to reach the receding water level in dry season



PHOTOGRAPH 2.2 Open Field *Kundi* (Water Tank) used both for domestic and public need

provided water in times of scarcity and long dry season. Even now there are a number of *kundis* being used in houses all over Rajasthan. People used locally available lime mortar for the construction of *kundi/tanka* because it was able to restrict seepage into the soil. The open field *kundi* was also used to harvest rainwater. The roof of the underground tank itself functioned as a catchment area (as shown in Photograph 2.2). An opening was made to enable the movement into the tank as well as to draw the water. We get a number of references in historical records which suggest that the state promoted construction of such techniques. The bigger form of *kundi* is known as *tanka*. Even today the water is drawn from the *tanka* of the medieval times to cater to the needs of the local inhabitants.

A number of archival records mention about the state extending financial and material support for the construction and maintenance of water appropriation mechanisms. Those peasants who contributed in digging up of new wells were also offered concessions in land revenue. The state also provided loans to peasants in order to enable them to buy *lao-charas* (rope and leather) so that they could operate wells to irrigate crops. The peasantry in general also took care of the water needs on its own by adapting various indigenous methods of water management. The tradition evolved in response to the given harsh environmental conditions. Better management of water along with drought resistant agricultural production had been a characteristic of pre-colonial India particularly in rain deficit region like Rajasthan. Water conservation measures discussed above suggests that states in traditional societies did play a crucial role with respect to water management for settlement purposes. Despite the harsh weather conditions, people were able to

come out with their own techniques of water conservation with state support in pre-colonial India.

Land-Use Change

Apprehensions and concerns about land-use change surfaced in the research agenda as academic debate few decades ago with the recognition that land surface processes influence climate and environment. One of the major impacts of land-use change in an arid and semi-arid zone, like Marwar in western part of India was soil degradation, ultimately leading to land degradation. It determines the vulnerability of the community living there to climatic, economic and socio-political dislocation and the adjustments in livelihood strategies. Land-use change is driven by synergetic factors, which include among others, resource exploitation, increase in the pressure of production on resources, and loss of adaptive capacity of the community in general. Wars work as trigger events in accelerating the process of land-use change. Rajasthan witnessed a series of incursions by the Marathas in the eighteenth century and it had major implications on the land-use change. In the wake of the Mughal decline and the consequent Maratha intrusion in Rajasthan, the exploitation of resources increased to unmanageable limits and it led to the economic disintegration of the agrarian system of Marwar. The state-power lost the control over land-use and was more anxious for land distribution and revenue extraction. The state asked the *thikanedars* and *pattadars* to pay more revenue to the state and they in turn passed on this burden on the peasantry.¹ The *pattadars* even started defying state orders and started collecting more than actually required forcefully from the peasantry.² The political instability of Marwar continued even during the nineteenth century. The British colonial government took control over the revenue and resources and the burden of revenue further escalated on the peasantry as they emerged as another shareholder to the collection.

The overall pressure on the economy was relatively greater in comparison to Eastern Rajasthan owing to the geographical location of the state. The state fell in semi-arid and arid zone of Western Rajasthan and the agricultural land available here was very limited. These agricultural lands had a limited production capacity owing to the total dependence on rain and non-introduction of new agricultural technology during these years. The ruling authorities lost the control over land use and were anxious more for land distribution and revenue extraction. This tendency proved disastrous for an arid region like Rajasthan, where famines were more

¹ Jodhpur Records, Basta no. 92/7. Bikaner: Rajasthan State Archives. In this document there are references to the amount realized from various *pattadars* by Abhay Singh.

² Maharaja Vijaysingh-ri-khyat, 1997, Brajesh Kumar Singh (ed). Jodhpur: Rajasthan Prachyaividya Pratisthan, p. 114.

frequent. Here the impact of greater exploitation could become visible only in few decades as compared to the doab region and rain-fed areas where the effect of exploitation without infrastructure development was felt after much longer period of time. The pressure of revenue was so much in Rajasthan that it led to intensive use of land. It has to be noted that this was a region, especially Western Rajasthan, where one had limited cultivable land available to the peasantry. Further, the region had only a brief period of moisture availability to sow the seeds. And so the peasants had the tendency to exploit this limited period of moisture availability for agriculture. This created the main erosive hazard to the fertility of the soil because of human activity. Since the peasants were under constant pressure they had no option but to either till the soil or to desert the area. The moisture less soil was disturbed by these 'forced ploughing' and because of scarcity of water, surface soil used to get dried out and led to greater wind erosion of the soil. Soil is one of the main processes of land degradation and consists of physical detachment of soil particles by wind. This was a very common feature of Rajasthan and it led to the deterioration of the overall productive potential of the soil. In turn, soil degradation might have resulted in decrease of the productive land ultimately forcing the farmers to encroach upon unsuitable and vulnerable lands – wastelands, slopes and other marginal areas, and the 'village commons'.

The cultivators started making more and more constant use of land for cropping and thus disturbed the earlier practice of leaving it fallow for replenishing its fertility. This possibly resulted in the use of land beyond its ecological capabilities and as a consequence its productivity must have been affected. Further in Marwar area there was a tendency to shifting cultivation and during the eighteenth century there was shrinkage in this practice as well (Bhadani, 1999, 39). The settlement Report of 1930s also say that after three years of cropping, the land was left fallow for the next three years indicating that this was a common practice in the arid zone of Marwar.³ We must note that during the eighteenth century, when pressure of revenue increased due the frequent Maratha demands, the concept of leaving the land fallow was gradually being forgotten and so the impact on the fertility of the soil was negative. The available data show that although famines were a recurring phenomena in Marwar, its frequency increased during the nineteenth century.⁴

³ *Settlement Report-Rent-Rate Report of Pargana Merta, Parbatsar and Sambhar*, Hawala File No. 40V4, (typescript) Part I, Mehkama Khas, Govt. of Jodhpur, Rajasthan State Archives, Bikaner.

⁴ Famine is generally perceived as the outcome of the failure of crops due to natural disasters, usually drought. It is also seen as the result of a shortage of available food against demand. Amartya Sen believes that famine is the outcome of unequal distribution within the normal socio-political structure. Therefore, it may occur when natural fluctuations in climate take place, but when things get tough the poor are the first to suffer. Sen, Amartya. 1982. *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Clarendon Press.

Table showing frequency of famines in the 19th century

1.	1803-4
2.	1812-13
3.	1833-34
4.	1847-48
5.	1850
6.	1853
7.	1868-70
8.	1877-78
9.	1891-92
10.	1896-98
11.	1899-1900

- Sources:
1. Report on the Past Famine in Rajputana Native States, 1868, Foreign Department, Proceedings, May 1868. Letter dated 20.4.1968 from A.G.G. Rajputana to Secretary, Foreign Department, Government of India.
 2. Brooke, J.C. *Report on the Famine in Rajputana, 1868-70*. Bikaner :Rajasthan State Archives.
 3. Report on the Famine in the Native States of Rajputana, 1899-1900, New Delhi: National Archives of India.
 4. Kothawalla, Phiroze R. 1939. *Famine Programme Report Jodhpur Government*. Jodhpur.

There is no doubt that natural conditions were too harsh in Marwar and this was the prime factor in the history of famine in the region. But during the nineteenth century the political, social and economic factors also combined to aggravate the situation. We have frequent reference to relief provided by the local *thikanedars* before the second half of the eighteenth century,⁵ but later on most of these *thikanedars* even collected more than the normal.⁶ The *pattadars* were asked by the rulers of Marwar to pay a lump sum amount other than regular revenue.⁷ On the one hand, the strain of the East India Company's exploitation weakened the economy and reduced the power of resistance of the people against famines, on the other hand as a ruling authority it did not frame any major policy of famine relief and prevention. It was only at the end of the nineteenth century that the British government framed a specific famine policy- the first and the second Famine commissions in 1878 and 1897 respectively, and the third Famine Commission in 1901. But all these formations of commissions proved to be merely an eye-wash

⁵ Nainsi, Munhata. *Marwar-ra Pargana-ri Vigat*. Narayan Singh Bhati (ed.) Part I-III. Jodhpur: Rajasthan Oriental Research Institute.

⁶ Brooke, J.C. *Report on the Famine in Rajputana, 1868-70*. Bikaner :Rajasthan State Archives.

⁷ The detailed discussion could be seen in Singh, Vipul. 2004. Ecology and Encounters: The Maratha Demands and its Impact on Land-use Pattern in 18th Century Marwar. In Tapeswar Singh (ed.), *Resource Coservation and Food Security*, Delhi: Concept Pub.Co.

and the problem of relief reaching the poor remained. One of the independent British observers, Huntley, reveals the shocking situation prevailing during the nineteenth century. He claims to have seen a large number of dead bodies lying on the roadside and there was a large scale migration by the people to the neighbouring states. People were compelled to eat things unknown as edible, like wild roots, bark of trees and even human flesh to appease their hunger.⁸ All these facts reveal that the relief measures were taken in half-hearted manner. In fact, the British government followed the Malthusian policy of famine relief, i.e. supplying food to famine camps and the stronger reaped more benefit of the relief offered. Further, the commercial policy of the British government in the other neighbouring and potentially fertile areas also added to the deteriorating condition of Marwar. MacGill had written to the Secretary of State in 1870 that the deficit areas of Rajputana which previously dependent upon the supplies from the fertile plains of Malwa were now deprived of the same as the latter had started growing poppy.⁹ R.C. Dutt, writing in the early years of the twentieth century, had said that increases in land taxes, the replacement of subsistence crops with cash crops and the demands of British imperialism generally led to the increasing susceptibility of the Indian population to famine.¹⁰ Amartya Sen says that the failure of the specific groups to obtain food by legitimate means is the crucial issue in famine, and thus famine is largely a consequence of distribution and not of availability. And therefore, the government and its policy in the nineteenth century was an important contributor to the frequent occurrence of famines.

The most typical response to drought and famine situations in Marwar was to migrate. In the famine of 1868-69, there was a massive migration of one and half million people from Marwar.¹¹ In the famine of 1891-92 199,600 people (which was 8 per cent of the total population of Marwar) left with 661,906 head of livestock.¹²

⁸ As mentioned in Ramkaran. V.S. 1981. *Bankidas Granthawali, Part I*. Kasi. p.16.

⁹ *Enclosure to Famine Despatch 17th May 1870 from the Secretary of State.*

¹⁰ Appadurai has given emphasis on examining famine and control of resources in terms of moral economy. See Appadurai, Arjun. 1984. How moral is South Asia's economy? A review article. *Journal of Asian Studies*, 43(3): 481-497. In other words, while the overall availability of food is one of the factors in the occurrence of famine, the inequalities of access to resources are also significant. Amartya Sen calls it as the entitlement approach to famine. See Sen, Amartya. 1982. *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Clarendon Press.

¹¹ A detailed analysis of this could be found in Kachhawaha, O.P. 1980. A famine in Rajasthan (1868-69). In G.L. Devra (ed.) *Some Aspects of Socio-economic History of Rajasthan*. Jodhpur: Rajasthan Sahitya Mandir.

¹² Resident, Western Rajputana States. 1893. Report from the Resident Western Rajputana States to the First Assistant Agent to the Governor-General Rajputana. 24th April, 1893. Published in *Report on the Relief Operations in the Native States of Marwar, Jaisalmer, Bikaner, and Kisengarh in Rajputana During the Scarcity of 1891-1892*. Bombay: Examiner Press. (no date of printing).

Another possible response was intensification of agriculture, which by using the existing technologies led to detrimental environmental consequences and put a question mark on the sustainability of the land.

RELIGION AS A FORCE FOR CONSERVATION

Does religion play any role in shaping the way humans think and act? One of the earliest notable theoretical construct was proposed by Lynn White Jr. (White, 1967). He argued that moving away from paganism by Christianity paved the way for 'desacralisation' of nature. This shift opened the way for humans to begin the domestication and consequent transformation of nature. He further says that in contrast to religions of the East, like Buddhism, Christianity established 'a dualism of man and nature' and insisted that 'it is god's will that man exploit nature to meet his proper ends'. According to White (1967), the growth of science and technology led to manipulation of the natural world and this was seen as 'occidental, voluntarist realization of the Christian dogma of man's transcendence of, and rightful mastery over, nature' (1206).

Perhaps, Lynn White was trying to illustrate that religion was the most decisive force in shaping human societies. He did believe that religious values often operated below the level of conscious expression, yet it had direct impact on human behaviour. He strongly felt that human attitude toward nature is rooted in his religious beliefs. He says, 'what people do about their ecology depends on what they think about themselves in relation to things around them. Human ecology is deeply conditioned by beliefs about our nature and destiny that is, by religion' (White, 1967, 1207). White's thesis had a lasting impact on the academic world, in particular among the environmentalists. His notion was used by later scholars as focal point of debate. When he argued that Christianity 'bears a huge burden of guilt' for the ongoing environmental crisis, it created ripples in the West. Many believed that Christianity was not the reason for the problem, rather it provided solutions to the environmental issues. Scholars having this diverse opinion highlighted such elements within the Christian tradition that provide a kind of mandate to humans to be the guardians rather than destroyers of the nature. They argue that in the scriptures nature is depicted positively.

Beyond these two diametrically opposite views, we may propose that environmentalism at the bottom is a movement guided by religious ethics. One may have doubts about the role played by Christianity in environmental crisis, but the indirect link between religion and environment cannot be denied and White's hypothesis strikes a vital chord. Religion and its underlying beliefs have an extremely profound effect on the society in which it is established. The way a

community treats certain situations and nature is directly related to the belief system associated with the religion followed in that area. How people treat the environment is correlated with their tradition and customs evolved over a longer period of time and these are based on religion. (Singh, 2011a)

Indian Religious Tradition and Customs

In many parts of India, communities have inherited the rich tradition of love and reverence for nature through ages. Religious preaching, traditions and customs have played a big role in this regard. Many of the religions followed there in general have been the advocates of environmentalism. Traditionally they campaigned for such guidelines to the commoners that ensured an intimate contact and sense of belonging to the nature. It came in the form of directives to the believers to perform certain rites and rituals, so that it became a way of their life. Sometimes the messages of environmental protection and conservation are in a veiled form. Today, when world order is undergoing a serious crisis of ecological imbalance and environmental degradation, it has become all the more important for us to understand such religious traditions. J. Baird Callicott (1994), Karan Singh (1995) and David Kinsley (1995) explain at length the relationship between ecology and Indian religious traditions. While Callicott presents a connect between moral and ethical values through sacred texts and drama, Kinsley expounds a model for understanding pilgrimages and other Hindu customs as a form of ecological spirituality. One may also look at the details on Indian traditions and customs in National Report of Ministry of Environment and Forests, Government of India (1992).

Vedic Tradition

The culture of conservation of nature dates back to the ancient Vedic Period. The four Vedas called Rigveda, Samaveda, Yajurveda and Atharvaveda are full of hymns dedicated to the supremacy of various natural entities. The Rigvedic hymns refer to many gods and goddesses identified with sun, moon, thunder, lightning, snow, rain, water, rivers, trees, etc. They have been glorified and worshipped as givers of health, wealth and prosperity. The Rain God, Indra has the largest number of hymns attached to him. Sun worship is of vital importance in Vedic worship and has been worshipped in the form of different gods, like Surya, Martanda, Usha, Pushan, Rudra, etc. Today, it has been proved that Solar energy is the ultimate source of energy that regulates the energy flow through food chain, drives various nutrient cycles and thus controls the ecosystem functioning all over the earth, and

it was probably very well understood and realized by the ancient people as well. The Gayatri Mantra of Rigveda, which is chanted on every auspicious occasion means – let us adore the supremacy of that divine sun, the god head, who illuminated all, who recreates all, from whom one proceed, to whom all must return, whom we invoke to direct our understanding aright in our progress towards his holy seat.

Trees have also been given huge importance in the ancient Indian tradition. All the four Vedas are full of references of various herbs, trees and flowers and their significance. From time immemorial trees and plants were considered as “animate being and to harm them was considered a great sacrilege” (Upadhyaya, 1965, 1). Atharvaveda glorifies the medicinal value of various herbs. In the holy literatures, we come across references of trees, like *Kalpavriksha* and *Parijat* with amazing characteristics. We get frequent reference to *Padma* (lotus), *Vat Vriksha* (Banyan), *Palash* tree, etc., which have been given special regard and concern. Worship of Peepal trees is a ritual and the tree has been regarded as the king of trees in *Brahma Purana*. In course of time, many such plants and trees came to be associated with various gods and goddesses and then began to be worshipped. The scientists today would tell us that the peepal tree releases oxygen in the atmosphere day and night, thereby purifying the air. Similarly, Tulsi (*Ocimum*), Bael Patra (*Aegelmarmelos*), Durva (*Cynodon*) and Chandan (Sandalwood tree), Coconut, Banana, Ashoka, Lotus, Marigold, Chinrose and Aak (*Calotropis*) flowers hold special significance in various religious rituals. Trilochan Pande (1965, 39) has indicated three major factors which were responsible for the origin of tree-cult in India – its wood, leaves, fruits, etc., were useful for humans; it was believed that trees are possessed by spirits who guided humans in their distress; and humans developed a kind of respect for trees which provided them herbs.

Natural flora and fauna and its association with human beings has been depicted in epics like the *Mahabharata*, the *Ramayana*, and in literatures such as *Meghdootam*, *Abhigyanshakuntalam*, etc. They provide colourful portrayal of trees, creepers, animals and birds conversing with people and sharing their joys and sorrows and this proves that the people believed in harmony between man and nature. M.C. Mehta, a Supreme Court Advocate and internationally acclaimed environmental campaigner, in an interview to Gosling (2001, 152) says, ‘When I was a child I used to see women moving in a circle around a tree each morning, but I did not understand the reason. Now I do. I understand the scientific reasons underlying those beliefs. The *pipal* tree gives out oxygen continuously for twenty-four hours. Such scientific knowledge was put into a spiritual form by our ancestors’. The construction of sacred-groves was also a common practice in ancient period and is still found among a number of tribes. Sacred-grove consists

of a bunch of old trees, generally at the outskirts of the village. It was left at the time of clearing of forests by the original settlers of the village. The forests were regarded as the holy abodes of gods and goddesses or spirits and hence protected with utmost care. Cutting of trees was prohibited in these areas and no body dared fell any tree, partly because of their religious faith and partly due to the fear of facing the wrath of the gods, goddesses and spirits. In many of the sacred-groves, 'periodical sacrifice and offerings are made to the gods by the villagers during festivals and other occasions' (Sahay, 1965). This tradition of sacred-grove could be matched with the contemporary notion of Biosphere Reserves.

Wild animals and even domesticated animals have also been given a place of pride and respect in the ancient tradition. Many of the Hindu gods and goddesses have some particular animal or bird as their carrier called *vahan*. These include lion, tiger, elephant, peacock, swan, owl, vulture, ox, bull, mouse, horse, etc. The attachment of the wild animals with peoples' religious belief played a significant role in keeping it intact for so very long in India, until the colonial rule led to intensive hunting of wild animals. The feeling of sacredness attached to wildlife protected them from getting extinct and contributed in maintaining ecological balance. For instance, snakes, due to their poisonous nature would have suffered every chance of wrath and consequent extinction by humans. But snake worship and its attachment with god Shiva was a conscious effort by our saints to preserve the snakes on the earth (Singh, 1995). Snake is an important link in the food cycle and also play a significant role in maintaining the ecological balance.

Conservation Teachings in Buddhism and Jainism

Buddhism and Jainism, the two most popular heterodox sects of ancient times also advocated conservation of nature. Buddhism believed in tolerance, love, compassion, forgiveness and non-violence to all. It preaches the middle path and is more moderate in nature. Jainism advocates complete non-violence or *Ahimsa*. Jainism treats every creature on the earth including the smallest insects or microbes as of equal importance and forbid their killing by all means. This perception went a long way in preserving the biodiversity on the earth. While Jainism preaches complete non-violence, Buddhism preaches that killing of an animal or felling of a tree should not be done until absolutely necessary. Buddhists have a great love for planting more and more trees. The Mauryan ruler Asoka, who was a great follower of Buddhism, was responsible for planting trees all over his vast kingdom. During his regime killing of many animals was prohibited and royal punishment and penalty was attached with such non-compliance of orders.

Historians believe that Buddhism and Jainism became popular largely because of the fact that they preached non-violence and protection of animals and trees. Arguably, these religions emerged on the scene to probably counter the Brahmanical customs of animal sacrifice during *Yajnas*. Mahavira gives the following preaching to his followers about the environment in the Acharanga Sutra – 'The elements of nature were described as living beings and under the fundamental principle of *ahimsa* (non-violence) these were to be protected in all ways – no waste, no overuse, no abuse, no polluting. If we follow these principles, then we would stop destroying our environment as well as preserve the resources that are available for all to share. If there are more resources available for all, then the poor will also get a fair share thereof' (*Faith and Ecology*, 2010).

Similarly, Buddhism also had a very strong ethical tradition – 'Buddhism, at least its primarily monastic tradition as we know it from the canonical texts, was on the whole, impressed not so much by the undeniable beauty of nature as by its equally undeniable somber aspects: the struggle for life, killing and being killed, devouring and being devoured, greed, suffering, and especially by the ubiquity of decay and impermanence' (Schmithausen, 1997). Sahni (2008) writes that 'the method of obliterating greed, hatred and delusion rests in the teachings of the Buddha'. Gautam Buddha probably identified the environmental crisis quite early. His identification of the 'three principles with all the misery and anguish present in the world and his prescription of a technique to hasten their downfall, acts as the solution to the spreading environmental epidemic' (Sahni, 2008, 166).

Bishnois and Conservation

Even during the medieval period many religious sects became popular which advocated conservation of natural environment vehemently. One such sect was the Bishnoi sect that became very accepted in a climatically hostile zone of Rajasthan. Guru Jambheshwar was the founder of the Bishnoi sect and he was a great environmentalist. It was in the fifteenth century that he realised that protection of wildlife and trees are of prime significance for human survival. He based his teaching on 29 principles (*bis* and *nau*) dealing with various aspects of life and laid great stress on having compassion towards all living beings and protection of innocent animals. He advocated the banning of tree-felling since he believed that trees are the basis of a harmonious and prosperous environment on the earth. He asked his followers to have mercy on plants and animals. He also cautioned that if humans kill the animals or fell trees they will have to face the consequences leading to the end of their life. Modern environmentalists have also established that

deforestation leads to soil erosion, desert formation, loss of soil fertility and leads to disasters due to loss of natural prosperity. The love for trees was so greatly infused in the minds and souls of his followers that in Khejrli village of Rajasthan almost 363 young and old men and women embraced the Khejri trees (*Prosopis cineraria*) to protect them from being felled by the king's men. A local ruler had ordered the cutting of *khejri* trees to use them for his lime kilns as fuel. The Bishnois hugged them and many were killed in the episode. Later, a temple was built in the honour of Bishnois martyrs. One of the famous lady of the movement was Amrita Devi Bishnoi. The Chipko Movement led by modern environmentalists, like Sunder Lal Bahuguna and Chandi Prasad Bhatt are also guided by such noble ideas. The followers of this movement popularised the slogan 'what do the trees bear – soil, water, fresh air'. Thus, the commoners from a semi-arid zone have understood the real value of trees. *Khejri* is one of the most important food for the desert region livestock in Western Rajasthan. It has high nutritious value for camels, cattle, sheep and goat. A unique feature of this tree is that it is heavily lopped with green leaves even during the dry months in winter, when no other green fodder is available in the dry tracts. The people from the semi-arid zone of Western Rajasthan encouraged the growth of *khejri* tree in between the cultivable land and pastures because its extensive root structure stabilise the shifting sand dunes. It also fixes nitrogen through microbial activities, according to scientists. Villagers also used the leaf as an organic matter for rejuvenating the non-fertile soil. During my interaction with the villagers of the region, I was told that its flower mixed with sugar is used by women during their pregnancy as safeguard against miscarriage. Its bark is used as a tonic to cure dysentery, asthma, common cold and rheumatic arthritis, etc. Thus, the Bishnois' conservation movement was purely an attempt to protect trees, and therefore, they attached religious ethics to the *khejri* tree. Few years back, Bishnois of Jodhpur district in Rajasthan filed a legal case against the film stars who were on a hunting spree and killed black bucks and chinkara. Today, one can find live evidences of tree and animal conservation among the Bishnois.

Environmental Movements in India and Religion

Like the Bishnois' hugging of *khejri* trees and the consequent movement, there are numerous references in Indian history of such resistance. The nineteenth and the twentieth centuries are full of instances of resistance against forest cutting. Most of these movements were largely against unjust forest laws which affected the way of life of the local people, especially the tribals. The creation of 'government protected forests' by the colonial government proved fatal for the tribals who were

purely dependent on the forests for their livelihood. The colonial forest policy, since the second half of the nineteenth century was an important watershed in the history of India's landscape and ecology. The concept of communal ownership and access to unclaimed land and forest of the pre-colonial period was done away with and was replaced by 'government forests'. The creation of a government forest service in India in the mid-nineteenth century set in motion a programme that changed the systems of forest management and recast it in the 'continental mould'. The Indian Forest Laws were passed in next fifty years with emphasis on restricting resource use for the people in general. This proved fatal in the long run and greatly disrupted the harmony that had been in existence between man and nature during the pre-colonial period.

The local tribal communities were the worst hit by 'government forest departments'. Earlier also, the forest communities had been subject to pressure of the agrarian communities of the plains, but the magnitude of impact was nothing as compared to the consequences of the state takeover of the forests under the British rule. Before the nineteenth century, the commercial exploitation of the forest produce was restricted to pepper, cardamom or other spices, whose extraction did not affect the ecology of the forest and the region dangerously. But the coming of the colonial government meant extraction of timber on large scale and this led to a qualitative change in the utilization of forests. It also meant an intervention in the day-to-day lifestyle of the forest communities who were largely hunter-gatherers and shifting cultivators. State reservation of forests drastically affected the subsistence activities of these communities. Madhav Gadgil and Ramachandra Guha (1997) mention that the 'forest and game laws affected the Chenchus of Hyderabad' by making their hunting and forest products gathering illegal. Similarly, the *jhum* or shifting cultivation was banned by the British calling it as primitive and unremunerative form of agriculture. Elwin has given a detailed account of the measures taken by the British administration to combat *jhum* and the consequent opposition by the Baiga tribe of Madhya Pradesh. In some areas, tribal resistance took a violent and confrontationist form. 'This was especially so where commercialization of the forest was accompanied by the penetration of non-tribal landlords and moneylenders who came to exercise a dominant influence on the indigenous population' (Gadgil and Guha, 1997). Their conflicts with the state and agrarian society sharpened over time. The tribals set fire to reserved forests, defied restrictions on grazing rights, raided peasant communities, destroyed crops, and carried off peasant cattle.

Even after formation of independent government in 1947, the forest policy of the government reiterated the main tenets of the colonial act of controlling all aspects of forest management through 'government forests'. It led to extensive

road building throughout the Himalayas leading to selective felling of commercial trees, especially for paper industry. It was then followed by planting of quick-growing species, like eucalyptus, teak, rosewood, pine, etc., and then felling of such trees for commercial use. The Chipko and later Appiko movement emerged out of these post-independence forest policies. These movements were led by individuals, such as Mira Behn, Sunderlal Bahuguna, Anna Hazare, Chandi Prasad Bhatt, etc., who were motivated by Gandhian ideology of non-violent satyagraha. We find many of the Hindu elements in these environmental movements after 1947. One gets frequent reference to the use of devotional readings from the Bhagavadgita. We could see the use of religious practices like *padayatra* and fasts, etc., in these movements. The communities resisting the government policies were mainly attached to the forests and they had 'a symbiotic relationship with their natural surroundings' (Gosling, 2001, 66). Anna Hazare used village temple as the focus for eco development in his area in Ahmadnagar district of Maharashtra. He involved people of the area in the water management schemes with the logic that 'rain water should be trapped where it falls' to raise the water table. He got stream embankments constructed by the people in his village. The ground water table soon rose in the locality and nearly 400,000 trees were planted. The food production in the area increased so much that people started exporting food and surplus was used for building schools in the area. Hazare's case is the best example of use of religion as a force for conservation. Here the 'traditional symbol of Hindu orthodoxy was transformed to enable it to play a vital contemporary and ecumenical role' (Gosling, 2001, 67).

If we look at the very root of the environmental movements in other parts of the world and India, there is a major contrast, and possibly the solution to our question poser lies there. Christopher K. Chapple has given a comparative analysis of the way environmental movements in the USA and India grew. 'Whereas in the American context, the early rallying for environmental action came from scientists and social activists with theologians only taking interest in this issue of late, in India, from the outset, there has been an appeal to traditional religious sensibilities in support of environmental issues' (Chapple, 2001). Thus, the Indian traditions, customs and religious belief enlighten us for the protection of the trees, flora and fauna and wild life. They teach us one of the fundamental principles of ecology that every living entity of the biosphere has its own important role in the flow of energy and cycling of nutrients, which keep the world going. Environmentalists, therefore, have started realising the significance of religion as a force for conservation and have emphasized on traditional knowledge system of the people. The teachings of religions could be used in positive sense for developing the concept of 'eco-spirituality' (Narayan and Kumar, 2003).