
UNIT 5 ENVIRONMENTAL ISSUES IN THE EARLY MODERN SOCIETY

Structure

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5.0 OBJECTIVES

After reading this Unit you should be able to learn and understand about:

- environmental changes vis-à-vis human interaction in Indian subcontinent during early modern period;
- how Indian forests were regulated by Indian powers and changes introduced by policies under Company Raj;
- how Indian wildlife was adversely affected during early modern period;
- some indigenous practices of environmental conservation in 18th and 19th centuries;
- how famines and epidemics affected people in 18th and 19th centuries; and
- restoration of old and development of new waterworks for irrigation by British authorities.

5.1 INTRODUCTION

In this Unit we shall present brief environmental history of early modern period. It covers period of a century and a half i.e. 1700-1858 CE. This period witnessed dramatic political upheaval in Indian subcontinent. The mighty Mughal empire

established in 1526, now after death of its last imperial Mughal sovereign Aurangzeb in 1707, began to give way to its decline, though they managed to hang on till 1857. Mughal empire disintegrated fast; new independent dominions emerged such as Bengal, Awadh, Hyderabad and regional powers like Marathas, Mysore and so on. However, real rival that gave last push to Mughal empire was East India Company which arrived as a trading corporation but soon aggressively pursued its political ambitions and established itself as supreme power in the subcontinent. Environmental history of this period is to a great extent tied to fortunes of these political powers. In following sections, we shall attempt to take a look at varied developments relevant from point of view of environmental history from 18th century till mid of 19th century when dominions of East India Company were taken over by British Crown in 1858.

5.2. FORESTS AND FORESTRY IN EARLY MODERN PERIOD

Forests and forest products have always been important for various communities in history as valuable resources. Therefore, states throughout history of civilizations have claimed these resources in varying degrees, mostly limited to few selected items or varieties of plants and trees to generate revenue. They also maintained hunting reserves by protecting forests. In pre-colonial period it has been suggested that India's forests had been undergoing significant changes in terms of exploitation of its resources. In Mughal period rulers and landed groups regulated forested lands in limited way and revenue policies played crucial role in expansion or contraction of cultivation in relation to forests. Sometimes rulers staked their claims to wealth from trading certain forest products that could be lucrative. For instance, Tipu Sultan had asserted his rights over sandalwood tree. However, as British East India Company entered the scene the process of commercial exploitation of forests became rampant from late 18th century.

As political powers struggled with each other their military campaigns and deforestation became closely related. Apart from valuable resources forests also provided safe haven for enemy forces and sometimes, anti-social elements like dacoits and marauders. Therefore, destroying forests during battles had become a strategy to outdo enemies. Maratha armies during battles used to burn forests so that their opponents could not make recesses. During Tipu Sultan's Coorg campaign trees and bushes were cut away and burned for three miles along the road. Sikhs too denuded interior regions during military campaigns.

Britain as an island nation had been a maritime power for centuries and became supreme naval power in 17th and 18th centuries. As scramble for colonies gained momentum British reliance on navy increased greatly to overpower its rivals and gain larger share. Till mid 18th century British demands of wood for ship-building were satisfied by British oak forests but by 1760 it had become scarce. This situation provided South Asia a new context and Britain hoped to fulfill its demand of timber from Indian forests, especially of teak (*Tectona grandis*). Search for timber was also accentuated by revolutionary France and Napoleonic phase at turn of 18th and beginning of 19th century. Napoleonic blockade against

Britain resulted in cutting off supply lines for ship timber from Baltic region. East India Company in this early period exploited teak forests of Northern Sircars near Rajamundry port in east coast and also on west coast. This initial British interest in India's forests has been considered as predatory because Britain merely wanted to acquire more timber which seemed inexhaustible.

From 1780 onwards by using Indian teak, ships were built in dockyards at Calcutta. Around early 1800s at Bombay ships were regularly constructed. It was hoped that Indian teak would supply adequate timber for British shipping. To acquire regular supply for British shipping decision was taken to extend control over some teak forests. Control of trade in timber was seen as first step towards controlling private use of forests. This was put into practice in Malabar which was conquered in 1792 and even in Tenasserim, Burma that was annexed in 1826. In 1806 a Conservator of Forests was appointed in Malabar. Thus, we see that beginning of forestry was rooted in the desire to acquire regular supply of timber.

During this period concept of botanical garden was also introduced in India where hundreds of varieties of plants were planted and developed on experimental basis. James Anderson of East India Company developed a botanical garden near Fort St. George. Scottish surgeon William Roxburgh (1751-1815), first posted at Samalcutta near Madras, also supervised creation of Madras Presidency's botanical garden. In Bengal in 1788 Robert Kyd established a botanical garden near Calcutta which he called a 'Garden of Acclimatization'. It began with conceived idea of supplying teak timber to Company's navy for shipbuilding. Later, William Roxburgh became director of botanical garden at Calcutta. He added 800 species of trees and 2200 plants there.

Soon, due to rise in demand for various reasons commercial logging was extended to even those areas that were not under British rule. British territorial expansion in northwest and Punjab also led to increased deforestation. Newly established British cantonments needed wood for fuel and timber for construction which led to reduction of tree cover. Consequently, by 1850s acute scarcity of wood was felt. Now authorities in Punjab decided to regulate access to deodar (*Cedrus deodara*) or Cedar forests. Forests guards were also appointed to prevent illegal cutting of trees, cultivation, cattle grazing and lighting fires.

Trading goods also required wood for being packed and parceled to international destinations. One of these goods was opium which was traded openly in 18th and early 19th century before being illegalized. Even after Company's trading monopoly ended opium reached China through private traders. Opium trade required millions of wooden chests for transportation.

Effects of modern technological developments were seen on colonies which became new tools of colonial exploitation. Advent of railways in middle of 19th century in India increased pressure on India's forests. First railway line, from Bombay to Thane, was built in 1853 which was a mile-long broad-gauge track. It required around 2000 sleepers. It can be imagined then how many sleepers were required in subsequent expansion of railways in India. According to an estimate

by 1878 around two million sleepers had been used for construction of railway line. For making sleepers deodar, sal (*Shorea robusta*) and teak trees were used. Apart from high level of demand generated by railways wood was also required as fuel in areas where there was no coal. Crisis of supply of timber led to regulation of access to forests and its conservation.

1830s onwards numbers of scientifically oriented officials grew in India, Britain and other places in the world. Research publications increasingly focused on environmental degradation by human actions. These included deforestation, frequent famines, epidemics from water and air pollution and importantly, relating Company's policies that were responsible for creating adverse effects. Among rational solutions to harness India's natural and human resources was appointment of Conservators in different presidencies. Scottish surgeon Alexander Gibson was appointed Bombay Presidency's first Conservator of Forests in 1847. Similarly, in Madras Presidency Dr. Hugh Cleghorn was appointed as Conservator of Forests in 1856. Playing an important role in forestry in their conservation efforts they went beyond protection of timber to draw attention to connection between deforestation and drought. They emphasized on protecting forests to prevent droughts, maintaining water supplies to ensure safeguarding agricultural prosperity and problem of siltation in rivers and ports. These led to more intrusive government control over forests and prohibition of swidden (slash-and-burn) agriculture in some regions.

Regulation of forests affected tribals living in and around them who held forests as common property resource. They subsisted by collecting forest produce and practiced traditional methods of agriculture or shifting cultivation. It was known in Tamil as 'kothukadu' and swidden agriculture in Coorg area was known as 'kumri'. The British adopted a policy of restricting shifting cultivation. It has been argued that State control extended to forests was to generate more revenue and facilitate commercialization of forests. Extraction of timber for shipbuilding, extraction of sandalwood, establishment of tea and coffee plantations, exploitation of forest resources for iron industries and introduction of railways imposed severe restrictions on tribals regarding use of forest resources. Their life changed considerably. More and more tribals became agricultural labourers or associated themselves with agriculture-related allied activities. Due to deterioration in their occupational status they were alienated from their land. Similarly, in other areas groups that were on fringes of arable society were considered responsible for deforestation in addition to being lawless and unproductive. Their methods were considered ecologically destructive and wasteful.

Governor General Lord Dalhousie's Memorandum in 1855 further asserted right of the Company to take over all forests and considered it even its duty to manage them through 'Scientific Forestry' that was emerging in Europe. For this he appointed German-British Dr. Dietrich Brandis who was a doctorate in Botany and had training in German scientific forestry. Brandis was also made Officer on Special Duty and he played an instrumental role in regulating forests for

conservation. He was instrumental in establishing National Forest Department in 1864 and passing of First Forest Act in 1865.

East India Company had also initiated cartographic survey in India as early as mid-18th century. First Surveyor General Major James Rennell made detailed maps of Bengal. Soon, much of the rest of territories were mapped which included details on forests, mountains, rivers, roads, towns and settlements. By 1802 Great Trigonometrical Survey project had begun which, using theodolites, made detailed and precisely accurate maps. By 1857 Company had surveyed half of the subcontinent. It had monopoly on this data and discoveries about India's natural resources which it used to commercially exploit India's natural resources, especially lands and forests.

Company's intervention into lives of Indians through its policies resulted in violent reaction in middle of 19th century. Forest-dwelling Santhal tribesmen of Bihar rose in rebellion in 1855. Company had earlier uprooted and resettled them in Rajmahal hills. Since land revenue was major source of income for the British they wanted to augment it by extending cultivation in hitherto uncultivated regions. First, they tried to transform local tribe called Paharias into agriculturists but failed. The Paharias refused to cut forests and resisted touching the plough. So, Santhals appeared to them as ideal settlers. They were brought in foothills of Rajmahal region and settled by giving them land. Conditions of land grants included the stipulation that at least one-tenth of area was to be cleared and cultivated within first ten years. Consequently, they settled by clearing forests and started cultivating the land. The Paharias resisted initially but were forced to withdraw deeper into hills. Agriculturist settlements of Santhals expanded rapidly. Now they cultivated a range of commercial crops, dealt with trade and traders and also moneylenders. Shrewd moneylenders became notorious among peasants of Bengal for their deceitful ways in accounting and charging exorbitant interest on loans. State was levying very heavy taxes on land which led peasants to turn to moneylenders. Like other peasants the Santhals also came in grip of moneylenders and soon found their lands to be slipping away. They fiercely revolted against zamindars and moneylenders in 1855 which continued till 1856 and were conciliated only after creation of Santhal pargana. Similarly, several sections of Indian society from deposed princes, sepoys, alienated merchants to farmers, pastoralists and forest-dwellers disgruntled by policies of East India Company rose in Great Revolt of 1857, challenging its authority.

5.3 WILDLIFE: TOWARDS GREAT ANNIHILATION

Wildlife in pre-modern period was rich and diverse. Although hunting as a leisure activity for royals was popular and forest dwelling communities must also have hunted who mostly subsisted by it. However, Imperial Mughals or Great Mughals had restricted hunting of game animals and birds. They made hunting of lions and tigers a royal preserve. Under their later successors protection no longer remained effective. Notwithstanding this, from colonial records we find that even in beginning of 19th century wildlife of India was still so rich that it resembled Africa's.

Existence of forests and wildlife are inseparably linked. As East India Company was expanding towards hinterland westwards from east, after Battle of Buxar in 1764, we get a glimpse of existing forests and wildlife from colonial records. Captain T. Williamson's 'Oriental Field Sports' (1807) furnishes fascinating record of Indian wildlife when sport hunting had just begun, which points to abundance of wildlife during this period. An English lady who had organized an elaborate shooting hunt in 1837 in Rajmahal hills mentions abundance of tigers, rhinoceroses, wild buffaloes and wild hogs in hilly jungles. Major J.G. Elliot in his book Field Sports in India: 1800-1947 mentions that from Calcutta to Jumna (Yamuna), where British frontier extended, there were areas of thick jungles around settlements and cultivation areas where tiger, pig, deer, peacock, partridge, quail, snipe and duck swarmed. In Sundarban delta region of the Ganges tiger, deer, hog, rhinoceros, buffalo were plentiful. Jungles of Nepalese terai extended for 600 miles from United Provinces through foothills of Himalaya along frontier of Nepal. To south of it there were vast swamps and numerous lakes which harboured various animals like:

- 1) elephants,
- 2) tigers,
- 3) panthers,
- 4) sambhar,
- 5) cheetal,
- 6) barking deer, and
- 7) pig.

Most importantly, it was last remaining reserve of one-horned rhinoceros in India. From early 19th century sport hunting began to be organized by East India Company officials which increased in latter half of the century. First hunt to be established in India was as early as 1776 when 'Madras Hunting Society' was founded. English officers were born and bred in countryside in England where sport hunting was prevalent. Moreover, big game hunting was popular among British upper classes and Indian wildlife provided them with ample opportunities. In 19th century many English officers earned fame as great shikaris such as Williamson, Shakespeare, Burton, Sanderson, Forsyth etc. They hunted all kinds of wild animals but highest attention was paid to big game hunting that focused on hunting:

- 1) tigers,
- 2) lions, and
- 3) elephants.

There was little limit or restriction on shooting any kind of animals. In fact, right from late 18th century British policy was to generate high revenue by increasing cultivation which required clearing of forests and making it free of wild animals.

Therefore, people were actually encouraged to hunt wild animals. Grand Trunk Road built for faster and safer communication stretched from Bengal to northwest. For widening it adjacent forests were cleared which also led to reduction of wild animals in the area.

Hunting was not only a sport. It had also become a reflection of super-masculinity and status-symbol. Daring hunting expeditions on foot were appreciated as manlier than shooting from a machan or raised platform. Size of hunted animals also enhanced status of hunters. It has been argued that big game hunting became a short cut to status of being a gentleman. High numbers of big game hunt elevated status of hunters who prided themselves on their achievements. Consequently, all kinds of wild animals and birds were decimated. An English officer is said to have killed 300 lions alone. Rulers of princely states also conducted big game hunting and often invited English officers to join their expedition. It has been estimated that during British Raj 80,000 tigers, 1,50,000 leopards and 200,000 wolves were killed. This data shows a glimpse of the scale of destruction of wildlife till first half of 19th century.

During 19th century sport hunting also led to some studies that focused on understanding and recording specificities relating to life, habits, habitats of wildlife. Hunting only increased in latter half of 19th century which eliminated wildlife to a great extent. However, realization of this ecological impairment raised serious concerns that later in last quarter of the century led to steps towards protection-laws for wildlife.

5.4 INDIGENOUS PRACTICES OF CONSERVATION

Wood was extensively used for housing, furniture, agricultural tools, musical instruments, numerous other handicrafts and basic source of energy due to which its importance had grown enormously. As civilization progressed the need to conserve such a critical natural resource became more evident. Few communities realized the need to conserve and use resources judiciously. Few such conservation efforts have been recorded from Rajasthan.

Bishnoi community from Rajasthan is known for its attitude towards environment. Arising out of teachings of its founder Jambhoji (1451-1536) it gained wider following in Rajasthan, especially arid regions of Bikaner and Jodhpur. By 18th century the sect had become so influential that rulers were forced to respect his sermons. We come across official orders called parwana issued by kings of Jodhpur and Bikaner that prohibited cutting of green trees. Importance of Khejri (*Prosopis cineraria*) tree, gleaned by its depiction on their flag in 17th century, continued in following centuries as felling this tree was prohibited.

As forests were very few vegetation was sparse in central and western Rajasthan. It became urgent to protect existing ones. The urgency was felt to the extent that even punishments became commonplace for tree felling. Such examples come from kingdom of Amber in 17th and 18th centuries. It has been suggested that

state enjoyed control with respect to vegetation and accorded punishment for unauthorized tree cutting.

Some specific trees had gained important place for their properties and usefulness, religious and ritualistic reasons:

- 1) Peepal (*Ficus religiosa*), Bad or Barghad (*Ficus benghalensis*) were auspicious;
- 2) Neem (*Azadirachta indica*) and Jamun (*Syzigium cumini*) had medicinal properties; and
- 3) dominant tree of Rajasthan – Babool (*Vachellia nilotica*) – had economic and ecological value.

Therefore, their cutting attracted punishments. State, in many instances, also seemed to have controlled fodder and grass resources. For their military needs grazing lands were reserved so that mainstay of the army – horses, camels and elephants – could be provided with adequate grass. State could punish unauthorized cutting of grass. Moreover, apart from reserved grazing lands state could forcibly utilize even community and private grazing lands of rural areas. It is suggested by many instances mentioned in inscriptions, documents from different historical periods when people ask state to control their soldiers on march and prevent them from looting and destroying their crops and other resources.

Some rulers and landed groups even undertook afforestation programmes to provide for hunting grounds or for strategic defense of their forts. Most famous among them were Talpur Mirs of Sindh who began their afforestation programme in 1783 to maintain shikargahs (hunting reserves). Cutting of trees was generally avoided and permissions were required. Many such reserves existed when British annexed Sindh in 1843. Zamindars of Awadh also protected tree-cover and bushes around their fort to use them as secure asylum from revenue collectors. It has been recorded that these jungles were so thick that even shot cannon balls could not penetrate them.

Check Your Progress Exercise 1

- 1) Describe factors responsible for sharp reduction of tree-cover and destruction of wildlife in early Modern period.

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- 2) Provide some examples of indigenous conservation practices during 18th and 19th centuries from the subcontinent.

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5.5 FAMINES

Famines have been recurrent in history of the subcontinent. They were more systematically documented in 18th and 19th centuries. Under East India Company administration from 1765 to 1858 alone in Bengal there were about a dozen famines and four severe scarcities. Scholars argue that famines are not natural events but conditions like crop failure and drought are accentuated by maladministration and mismanagement by governing authorities.

Under the East India Company, first of famines occurred in 1769-70. It has been considered biggest calamity of 18th century. This famine devastated western and northern Bengal, Bihar and parts of Odisha. It was preceded by partial crop failure due to failure of monsoon in Bengal and Bihar in 1768. One-third of population perished due to famine and hunger. That there was no respite in terms of tax-relief from government and it was more concerned about collection of revenue is evident from the fact that more revenue was collected during famine year 1770-71. Even in some of colonial records concerns were raised at this situation.

In 1781 and 1782 there was drought in Madras region and in 1784 whole north India experienced severe drought. In 1783-84 a famine known as Chalisa famine gripped western Oudh, eastern Punjab region, Delhi, Rajputana and Kashmir. Approximately 11 million people were dead and many large areas were depopulated. From 1789-92 a widespread famine named Doji Bara famine occurred in parts of western India and Deccan. It included Madras Presidency, Gujarat, Deccan, Hyderabad, southern Maratha country and Marwar. The casualty was again around 11 million people and horrifying descriptions exist of death in such large numbers that the dead could not be buried or cremated. In Madras the Company carried out some relief work.

In 1803 modern Uttar Pradesh region experienced famine. In 1833 devastating famine in Guntur region of south India killed two lakhs out of five lakh people. Government initiated public works but mostly relief works among the helpless were conducted by religious philanthropic institutions. Drought and failure of crops led to Agra famine in 1837-38 which was spread in central doab, Agra region, Delhi and Hissar. It caused 0.8 million deaths.

In assessing underlying reasons for famines in India during this period Vineeta Damodaran argues that interventions made by East India Company and impact of modernization and development in 18th and 19th centuries have played a

significant role in it. Under Company Raj taxation was increased, sedentarisation was encouraged, advent of railways and private capital further caused to destroy traditional economies. Company introduced new regimes of property, adopted a policy of converting forested lands into arable land and looked at jungles as harbouring disorder and predatory tribes. After Company assumed the diwani land revenue was enhanced. Exaction of taxes was extremely harsh and caused great distress. It was worsened by demand of directors of East India Company that officers had to increase in investments without investments being made from England. They needed to generate enough revenue in India itself and use it for purchasing goods for exporting to England. Therefore, authorities were forced to raise collections even further and more harshly.

Recent studies have linked these recurrent famines with climatic changes occurring globally. A very significant role in these studies has been played by empirical evidence collected by East India Company surgeon William Roxburgh. He kept detailed meteorological records in Madras Presidency from 1776-93. He produced detailed multiyear tables by systematically recording barometric pressure, temperature and rainfall three times in a day. He used this data to correlate monsoon failures in Madras Presidency. Richard Grove has emphasized on impact of El Niño current and Southern Oscillation (ENSO) events in worsening climatic conditions globally in late 18th and early 19th century. These events affected by causing droughts in semi-arid zones in Australia, South Asia, Africa, the Caribbean and Central and South America. Australian government observers Sir Charles Todd and H. C. Russell at turn of 19th century had become convinced that Australian and Indian droughts usually coincided. Russell has also provided list of droughts in Australia from 1789-91 to 1884-86 and compared coincidence of Indian droughts. Out of 22 droughts occurring in Australia 10 droughts in India coincided with them. Till end of the period covered in this Unit i.e. 1858 there occurred seven such droughts.

Under Company Raj no effective scheme was prepared for relief work or prevention of famine. However, varied schemes were adopted by authorities at local level such as maintain reserved stock of grains, punishment on hoarding, loan for digging wells etc. We also see that surgeon Robert Kyd in Bengal after famine of 1769-70 attempted to develop famine-resistant crops in Calcutta Botanical Garden. Similarly, William Roxburgh, before coming to Calcutta, played a role in planting food providing trees such as plantain (*Musa paradisiac*), jackfruit (*Artocarpus heterophyllus*), breadfruit (*Artocarpus altilis*), opuntia (*Opuntia ficus-indica*), coconuts (*Cocos nucifera*), sago (*Metroxylon sagu*), dates and palmyra (*Borassus flabellifer*) to sustain population during famines in Madras Presidency.

5.6 DISEASES AND EPIDEMICS

The vast Indian subcontinent had diverse environments ranging from world's highest mountains to Great Plains and from tropical forests to barren deserts. Such varied region had its own peculiar epidemic diseases such as plague, cholera, small pox and malaria that had devastating effects. British colonial setup

in India was also affected by it as their officers and soldiers were inflicted by these deadly diseases.

There are reports of various plague outbreaks in India. In 1812 plague outbreak in Kutch spread to Gujarat and Sind and lasted for approximately 10 years. A disease having all symptoms of plague was reported in 1828 in Hissar region. In 1836 plague was reported in Marwar state of Rajputana.

Another epidemic disease was cholera with which officers of East India Company were not familiar. There were cholera outbreaks in beginning of 19th century but these were confined to Bengal. But Company was shocked by widespread cholera epidemics in India in 1817-1821. It seriously impacted troops and officers of Company which was otherwise considered a disease of poor people. There was no effective treatment for cholera in this period.

One of most feared and deadly diseases was malaria. Company had acquired territories in late 18th century and early 19th century into environmentally less accessible areas and politically marginal areas. Central Indian forested region, Rajmahal hills and beyond in east and Madras presidency in south made a triangle which was malaria-stricken. In colonial records and medical and topographical texts fever has been identified repeatedly as a primary attribute of Indian environment. The British came across it first in hilly forests in south which is why perhaps it was christened malaria where mala in Tamil meant hill. It was also referred to as 'jungle fever'. Till end of 19th century it was not known how malaria was caused and transmitted. It was believed that malaria was an airborne poison generated by decaying animal and vegetal matter. However, it was associated with an unwholesome atmosphere of marshy lands, floods, swamps, dense undergrowth and jungles. Some physicians by observation and experience tried to identify regions that were struck by malaria frequently and severely. These regions included marshy areas like the terai and areas with tropical climate like lower Bengal, Assam and parts of north India where the British built canals. Only by 1896-98 role of anopheles mosquito in transmitting malaria was discovered by Ronald Fuss.

David Arnold has argued that for the British these hilly areas were treated as ecological frontier. They were distinguished from the plains in terms of topography, vegetation, disease, climate, wild animals and tribal inhabitants. It was also seen in the dichotomy between forests and cleared land, tribal and agrarian societies. The British had conducted punitive raids from late 18th century on hilly forested regions of Jungle Mahals on western borders of Bengal, Khandesh in Deccan and Northern Sircars in Madras Presidency. Arnold has linked this ecological niche with resistance of forest tribes against British raids. He has argued that the terrain, vegetation and diseases had proved advantageous in resisting the British by forest tribes. Whole environment was inhospitable and deadly not only for the British but the fever even affected inhabitants of plains if they ventured out in hills. It was observed that hill tribes had developed some immunity to it and used it to their advantage. From June when it rained till February the environment was made deadly by the fever, apart from other

dangers like wild animals and attacks by forest tribes. When British troops were sent on an expedition to hilly regions of Rampa and Gudem in Madras Presidency they were struck by severe sickness caused by fever. The British even had to reconsider sending incursive campaigns into these areas so that loss of many lives could be prevented.

Small pox was also commonplace in India. In some places like Bengal and north India people associated it with a goddess called Shitala meaning 'the one who is cool'. She was considered to inflict it when angry and also cool the fevers of already afflicted. Therefore, she was worshipped and feared both. After 1769-1770 famine in Bengal smallpox epidemic killed millions of people. Edward Jener got breakthrough in 1796 and discovered small pox vaccine. In the following century small pox vaccination on a limited scale became available in India also.

5.7 WATER RESOURCES

In pre-British period apart from rain fed agriculture traditional methods of irrigation were used such as well, ponds, tanks etc. Some local powers had constructed small inundation canals. These continued in colonial period also but the British undertook repair of old canal channels and new canal projects on a large scale.

In Bari doab of Punjab during Shahjahan's reign his engineer-advisor Ali Mardan Khan had built 177 kms. long Hansli canal from left bank of river Ravi. It carried water to Shalimar garden at Lahore. Under Sikh rule (1763-1849) a branch of this canal was constructed to carry water to Golden Temple at Amritsar. During late Mughal rule around 1744 CE a small inundation canal called Shah Nahar was built on left bank of Beas river through private enterprise of village moneylenders.

Under Company Raj in early decades of 19th century restoration and improvement works were undertaken of those canals that were constructed in Sultanate and Mughal periods and were either relict or in use. These include western and eastern Yamuna canals or Eastern and Western Jumna Canal (EJC and WJC) as called in British records. Western Jumna Canal was originally built by Feroz Shah Tughlaq in 14th century. Later it fell into disuse but revived during Akbar's reign and modified during Shah Jahan's reign by Ali Mardan Khan. Again by 1705 it had gone out of use. In 1817 Mr. G. R. Blane of Bengal Engineers was entrusted to restore it and completed the task by 1820. After famine of 1832-33 the canal was enlarged and modified. Revenue that was coming from it encouraged the government to undertake further improvements. Eastern Jumna Canal or Doab Canal was also built in early 18th century but it was abandoned soon. It was partially restored by Rohilla Chiefs in 1784. The British undertook rehabilitation works in 1820s and it was opened in 1830.

Extensive improvements were also made to numerous dams and canal networks in Rohilkhand and Dehradun valley. The British also restored a 12-mile cut from west Kali Nadi near Meerut which was built by Muhammad Abu Khan.

Improvement of Hansli canal of Bari Doab was undertaken when the British occupied Lahore in 1849. It was opened in 1859 and irrigation started in 1861.

In south after Tanjore was ceded to the British in 1801 restoration and modification work of most impressive indigenous structure – the ‘Grand Anicut’ – on Cauvery or Kaveri river was undertaken. Original construction is generally attributed to Chola kings but various scholars put it in the range of 2nd-11th centuries. Extensive modification and enlargement of this anicut was undertaken by Sir Arthur Cotton in 1834. Palar Anicut System was constructed in 1855. Apart from these, Godavari and Kistna (Krishna) and Pennar Anicut Systems were also commenced respectively in 1844, 1852 and 1855. On Godavari and Krishna, it was Cotton again who constructed major dams.

Ganges Canal was first among purely British works. This grand project was originally conceived by Colonel John Colvin in 1836. Sir Thomas Cautley examined the project but was discouraged by some physical obstacles. However, after severe famine of 1837-38 it was revived and construction began in 1843. This grand canal stretched 350 miles from Hardwar to Cawnpore (Kanpur) and incorporated 650 miles altogether, consisting of main line and branches. Largest canal of the world in its times, it was opened in 1854 and became operational in 1857. Development-oriented Governor General Lord Dalhousie played important role in supporting these public works and also established Public Works Department (PWD) in 1854. These projects not only became a boon for people during famines but also brought huge financial profits to the British.

Check Your Progress Exercise 2

1) Describe how famines and epidemics devastated human life in Indian subcontinent during 18th and 19th centuries.

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2) Provide answers for following questions:

- a) When a national forest department was established in India?
- b) Who brought scientific forestry to India?
- c) Famines in late 18th and 19th centuries have been linked to which climatic phenomenon occurring in Pacific Ocean?
- d) Which canal repaired by the British was originally constructed by Feroz Shah Tughlaq in 14th century?
- e) Which canal was first among purely British works?

f) Who restored and enlarged Grand Anicut on Cauvery?

5.8 SUMMARY

Environmental history of early modern period was influenced deeply by political developments in the subcontinent. Subduing other rivals, British East India Company established itself as supreme power by early 19th century. As British control was extended in various deeper regions of India they became familiar with vast natural resources, especially forests. Initially teak forests were exploited for shipbuilding but soon timber was required for various purposes by the Company. To ensure incessant supply of timber they started regulating forests, restricting access of tribals and other private individuals. Commercial exploitation of forests without any concern for conservation led to reduction of tree cover. Due to some rising concerns Conservators of Forests were appointed by the Company little before mid of 19th century and later, scientific forestry was introduced but these also had an angle of commercial exploitation. Later, development of railways put heavy burden on forests for supplying timber. Company policies even interfered with lives of tribals, severely affecting their livelihood. Wildlife inseparably linked with forests was also adversely affected by extending cultivation or development projects. However, shikar by British officials and Indian princes acutely reduced number of wild animals, especially lions and tigers and sent some of them to verge of extinction. We also learnt about some indigenous practices of conservation of forests and trees in Rajasthan which even included punitive measures.

During this period a number of famines struck the subcontinent due to drought but it was made worse by mismanagement of British administration. Famine was also accompanied with various epidemics like plague and cholera which claimed millions of lives. Other diseases like malaria apart from Indian people affected Company soldiers and officials also. Lack of knowledge about its origin and proper diagnosis led to deaths in large numbers. Canals constructed by the British too contributed in spreading it. Several waterworks like Eastern and Western Yamuna Canals, Ganges Canal and Grand Anicut at Kaveri were constructed which supplemented more traditional ways of irrigation facilities and the British reaped huge financial benefits. Thus, in early modern period British policies led to deterioration of forests and wildlife in the subcontinent which continued even later till independence of the country. However, developing concerns also led to foundation of certain protective institutions and regulations.

5.9 KEY WORDS

Anicut: Masonry check dam constructed across a river or stream for irrigational purposes.

Botanical Garden: Garden dedicated to collection, cultivation, preservation and display of wide range of plants.

Cholera: An acute intestinal infection caused by ingestion of contaminated water or food.

El Niño-Southern Oscillation (ENSO): A recurring climate pattern involving changes in temperature of waters in central and eastern tropical Pacific Ocean. It has three phases – El Niño, El Nina and neutral. While El Nino is warm phase, El Niña is cold phase. During El Nino events ocean surfaces become warm with sea surface temperatures going above average in central and eastern tropical Pacific Ocean. It affects atmosphere too. This ENSO cycle directly affects rainfall distribution in tropical area. Over Indonesia and Australia rainfall tends to become reduced. Recent studies have linked it with Indian monsoon, emphasizing its role in weakening the monsoon, causing shortage of rainfall.

Famine: Severe shortage of food due to crop failure and mismanagement of supply, resulting in violent hunger, starvation and death.

Malaria: An infective disease caused by Sporozoan parasites that are transmitted through bite of an infected Anopheles mosquito. It is marked by sudden chills and fever.

Plague: A serious and sometimes fatal infection of rodents caused by Yersinia pestis and accidentally transmitted to humans by bite of a flea that has bitten an infected animal. In human history plague has claimed a very large proportion of human lives across the globe.

Scientific Forestry: Science of forest and tree plantation management. Natural forests with diversified plants are cut down and substituted with one particular kind of tree is referred to as plantation. It developed in Europe and in India it was brought by Dr. Dietrich Brandis in latter half of 19th century. It facilitated commercial exploitation of these forests during colonial rule. Now scientists criticize it because it led to decreasing diversity in the forest which is the balancing characteristic of ecology.

Small pox: A highly contagious viral disease characterized by fever, weakness and skin eruption with pustules that form scabs, leaving scars.

Sport hunting: A form of hunting that was generally not to procure food but just for sake and joy of hunting. Hunters killed wild animals like tigers, lions, cheetahs, elephants etc. by shotgun and took pride in number of animals that were killed.

Swidden Cultivation: Mostly practiced by forest tribals, it is a traditional method of cultivation in which an area of land is cleared by cutting and burning existing vegetation and made cultivable.

5.10 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) You should be emphasizing how various Indian powers burned forests during battles and East India Company's policies of extending cultivation by clearing forests, felling teak trees for shipbuilding, for various building constructions in cantonments as it expanded into new areas and development projects like

railways etc. You should see how shikar decimated wild animals. Consult Subsections 5.2 and 5.3.

2) Give examples from Rajasthan. Consult Subsection 5.4.

Check Your Progress Exercise 2

1) You should look at various famines and diseases by consulting subsections 5.5 and 5.6.

2) (a) 1964 (b) Dr. Dietrich Brandis (c) El Niño and Southern Oscillation (d) Western Yamuna Canal (e) Ganges Canal (f) Sir Arthur Cotton

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