
UNIT 18 UNDERSTANDING OF ENVIRONMENT

Structure

- 18.0 Introduction
- 18.1 Industrialism: Environmental Discourse
- 18.2 Colonialism: Environmental Discourse
- 18.3 Conservation
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- 18.5 Exercises
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18.0 INTRODUCTION

Colonialism is generally considered an environmental turning-point in the history of India. An era of unprecedented resource exploitation begins and natural resources get geared to the requirements of the nascent English industries. The commercial interests come centre-stage and a large chunk of communities dependent on various resources-use practices for their subsistence are marginalised. The twin-processes of industrialisation and colonisation operate in tandem and bring in environmental impoverishment for India. The colonial power, in this process, is guided by its own understanding of the environment of the colony and the policy of resource use unfolds and becomes operational in consonance with this understanding. In the details that follow we attempt a portrayal of this perception. In this task, we are not helped much by evidence that is direct and in any sense prolific. The description is therefore not very elaborate, yet it is informative.

18.1 INDUSTRIALISM: ENVIRONMENTAL DISCOURSE

Industrial Revolution was a momentous occurrence. It signaled a brake for the *biological regimes* and initiated a process of industrialisation that was impregnated with enormous new possibilities of the use of natural resources. Industrialisation was accompanied by technological advances of far reaching impacts and they together unleashed processes that altered completely the prevailing picture of the natural world. Fernand Braudel had said: “In fact, until the eighteenth century, a Jungle Book could have been written about almost any part of the globe” (*The Structures of Everyday Life*, tr. Sian Reynolds, Harper and Row, 1985, p.69). Within a century since then, however, echoes of wailing voices could be heard saying *How Green Was My Valley?*

England was a pioneer in industrialisation. It was a special circumstance

that had given England a position of eminence. Industrialisation was a complex process that had got initiated there due to a peculiar combination of factors. The major areas that had come under the splurge of industrialisation were agriculture, demography, inland transport, technology, trade and industry. In fact there was no sector of private or public life in England that was actually immune from industrialisation. An understanding of industrialisation and its working in England is therefore of help to us in gaining insights into the formulation of environmental perceptions of English colonisers.

Agriculture provided the necessary backdrop against which the industrial changes unfolded. Experiments with soil usage and the introduction of a variety of crops was perhaps the first stage where notable changes became evident. The fertilising properties of soil were enhanced by liming and marling the soil (adjusting the right mix of clay and lime in the soil) and a pattern of crop rotation experimented for rejuvenating the different layers of soil. It is an interesting fact that industrial and mechanised equipment in agriculture were introduced only around mid-nineteenth century. Braudel notes that changes in agriculture “come not so much from machines or wonder crops as from new methods of land use; new timetables for ploughing; new forms of crop rotation which eliminated fallow and encouraged grazing, a useful source of fertiliser and therefore a remedy for soil exhaustion; attention to new strains of crops; selective breeding of sheep and cattle; specialised farming for higher yields – all with results which varied according to region, to natural conditions and to the constraints of the market which were never the same in two places. The resulting system was what would in the nineteenth century be called *high farming*...” (*The Perspectives of the World*, tr. Sian Reynolds, Harper and Row, 1984, p.559).

One of the early changes in the industrial sector was the introduction of coke as a fuel replacing charcoal. The most noticeable use of coke was in blast-furnaces for making pig-iron. In “about 1760, the cost price of charcoal-fired smelting was about £ 2 per ton greater than that of iron produced by the rival method” the coke fired blast furnaces (Braudel, *op. cit.* p.569). The other significant change was in the cotton sector where a production boom began to show by the close of the eighteenth century. Here India was directly involved. To quote Braudel again whose succinct remarks are of high value in our discussion: “The cotton revolution, first in England, but very soon all over Europe, began by imitating Indian industry, went on to take revenge by catching up with it, and finally outstripped it. The aim was to produce fabrics of comparable quality at cheaper prices. The only way to do so was to introduce machines – which alone could effectively compete with Indian textile workers. But success did not come immediately. That had to wait for Arkwright’s water-frame (1769) and Crompton’s mule (1775-8) which made it possible to produce yarn as fine and strong as the Indian product, one that could be used for weaving fabric entirely out of cotton. From now on, the market for Indian cottons would be challenged by the developing English industry – and it was a very large market indeed, covering England and the British Isles, Europe (where various continental cotton industries

were however soon putting up their own competition), the coast of Africa, where black slaves were exchanged for lengths of cotton, and the huge market of colonial America, not to mention Turkey and the Levant – or India itself. Cotton was always produced primarily for export: in 1800 it represented a quarter of all British exports; by 1850 this had risen to fifty per cent” (Braudel, *op. cit.*, p.572).

An extraordinary expansion of English trade was one more feature of industrialisation. After 1760 the English overseas trade continuously increased. The centre of gravity of this trade moved towards American colonies and India. Significantly this success, in most cases, was achieved by force. Along side this, came improvements in inland transport. The Canal fever - as the development of navigable waterways is generally known as - began in 1775 and by 1830s wide and narrow canals had crisscrossed the entire country. The main intent was to facilitate haulage of resources on a bulk scale so that growth of English industries would not be stifled for want of natural resources in the proximity of the sites of the industries.

These details point towards two conclusions. In the first place industrialisation resulted into a good deal of destruction, adaptation and restructuring. The traditional structures of agriculture were impaired and the land use patterns changed significantly. For instance, animal farming became more profitable than arable making farmers to shift to forage crops. Since forage crops do best on light and sandy soils, these became the most productive land in England. Heavy clayey soils by contrast, previously regarded as the richest for cereal growing, and unsuitable for forage crops, were hit by the low prices created by higher yields in rival regions (Cf. Braudel, *op. cit.*, p.560). Secondly, industrialism i.e. the adaptation of an industrial mode of life, became the dominant social norm. In other words, this meant a transition from a predominantly agricultural society to one in which manufacture dominated.

The central discourse under industrialisation was about the revolution in the mode of resource use – transforming resources from one form to another and making it possible for resources to be transported over large distances, away from the places of their origin.

Evidently the environmental perception or understanding of the English colonisers was mediated by this discourse. In the English understanding of environmental conditions in India in the eighteenth century but especially since the battle of Plassey the following features were quite dominant:

- 1 The natural resources of India needed to be elevated to the level of commercial use in place of the prevalent general practice of use for subsistence purposes;
- 1 The resource-use practices needed to become free of any restraints so as to enable resource exploitation;

- 1 In this process, community control over resources required to be unshackled even through legal mechanisms if needed; and
- 1 A conflict in the ways of life or cultures was deemed inevitable in this process.

As we shall see in Units 20 and 21, this understanding guided the exploitative working of the colonial policy in the case of water resources and forest resources.

18.2 COLONIALISM: ENVIRONMENTAL DISCOURSE

Colonisation of India was an occurrence of singular significance. The largest colony in the world was created by the classic capitalist power. The long historical process, from about the middle of the eighteenth century till the beginning of the twentieth century, was fraught with devices of resource exploitation of an unprecedented kind interceded by an environmental perception that oriented resources principally towards market. The colonial discourse on environment has been nicely elaborated by Alfred Crosby in his work *Ecological Imperialism: The Biological Expansion of Europe* (CUP, 1986). We use his argument (as given by Gadgil and Guha) here and split and paraphrase it to show the consequences of colonial discourse on environment as below in line with our discussion:

- 1 European colonisers exterminated native ecosystems and populations;
- 1 The complex of weeds, animals and diseases brought by Europeans devastated the flora, fauna and human societies of the colonies;
- 1 It created 'Neo-Europes' that dominate the New World today;
- 1 In this biological expansion of Europe there were three areas that were 'within reach' but 'beyond grasp' – Middle East, China and India;
- 1 Population densities, resistance to disease, agricultural technology and sophisticated socio-political organisations made these areas more resistant to the ecological imperialism of Europe;
- 1 Thus 'the rule (not the law)' was that although Europeans did conquer the tropics, they did not succeed in Europeanizing the tropics, not even country sides with European temperatures (p.134);
- 1 Portmanteau Biota (collective term for the organisms the colonising whites brought with them) enabled the European powers to easily overrun the temperate regions of North and South America as well the continent of Oceania;
- 1 In the case of more ecologically resistant civilisations like India and China a different strategy had to be adopted;

- 1 In India, the British could not create neo-Europes by decimating indigenous populations and their natural resources base;
- 1 But they did intervene and radically after existing food-production systems and their ecological basis;
- 1 Moreover, by exposing their subjects to the seductions of the industrial economy and consumer society, the British ensured that the process of ecological change they initiated would continue, and indeed intensify, after they left India's shores.

The English colonial control of India began with the acquisition of the power to collect land revenue – the *Diwani* rights of Bengal, Bihar and Orissa. What seemed on the face a simple political process had grave and quite far reaching implications. Irfan Habib describes the process and its meaning exquisitely: “The East India Company, which obtained this power, was controlled by the great merchant-capitalists of London. These merchants had so far conducted a trade, based on the import of Indian piece goods (muslin, calico, chintz), silk, indigo and spices, that was financed mainly by the export of treasure. Now, suddenly, they found in their conquests the ultimate bliss that every merchant dreams of: to be able to buy without having to pay, and yet be able to sell at the full price. This could be achieved by treating the entire revenue of the country as gross profits. From these the expenses necessary for maintaining government and army, and law and order – the costs of maintenance of the existing system of exploitation – had to be deducted in order to yield the net profits. These could, in turn, be invested for the purchase of Indian commodities, the so-called ‘investments’. The purchase of these commodities in conditions where the buyer had a monopoly, and their sale in markets throughout the world, further enlarged the profits before the ‘tribute’—a word freely in use for it at the time—was finally received in England. The revenues from the conquests dwarfed the amount of bullion that had once financed English trade; and, accordingly, the exports of Indian commodities underwent an enormous increase. British imports originating in ‘East India’ increased from £1.5 million in 1750–51 to 5.8 million in 1797-98, from 12 per cent of total British imports to 24 per cent. In contrast, the British exports to East India rose only from 6.4 per cent to 9 per cent of total British exports. Unlike the later imperialists, fighting for markets in the colonies, these pre-industrial conquerors were hunting for colonial commodities, which had the whole world as their market” (‘Colonialisation of the Indian Economy’ in *Essays in Indian History*, New Delhi, 1995, pp.299-300).

Interestingly the profits so gained by English did not come from commerce but were made available through the collection of land revenue. Thus if the profits had to be increased the land revenue too needed to be enhanced. A great pressure was exerted on the farmers/peasants for maximising the land revenue. The results were terrifying as the agriculture was ruined. The colonial perception of the commercial use of resources had yielded disastrous results.

During the period coinciding with the first half of the nineteenth century “the colonial objective changed from seizing Indian commodities to seizing the Indian market. The changed objective not only made the East India Company’s monopoly over Indian internal commerce and overseas trade obsolete, but positively required free trade...

The English exports of manufactures, textiles in the first place, not only practically wiped out the Indian exports of cotton goods, but also entered India to challenge Indian manufactures, in their home market....” (Irfan Habib, *op. cit.* p.319). The result was a second disaster; de-industrialization of India had been effected.

About mid-nineteenth century the capital investment at home (in England) had reached a saturation point. This gave rise to an intensified race for markets and export of capital. In India this capital was used for laying railways. Once this process had progressed up to a certain stage, the influx of imports from England gained momentum. This onslaught of imports had grave consequences for the traditional craft industries of India. They were ruined beyond repair. Such was the ecological-environmental encounter between India and its colonial conquerors, the English.

18.3 CONSERVATION

It is generally argued that the age of discovery and associated maritime travel gave rise to a new way of looking at man-nature relationship. There were two kinds of major changes involved in this new vision. The first related to the emergence of a view that natural environment surrounding the human society was pliable to man’s desired changes. The second gave rise to a new kind of significance being attached to nature that was also often imitated. The development of the idea of botanical garden was copied from Middle East (Cf. Richard H. Grove, *Green Imperialism*, New Delhi, 1995, p.24). By the time we arrive at the seventeenth century “a fundamental displacement of social and symbolic meanings away from the confines of religious contexts and into more secular settings” takes place. Soon the “idea of a flawed and fallen natural world in opposition to a spiritual heaven became less attractive as the whole globe became technically and economically more reachable and as its extra-ordinary variety and richness, especially in tropical regions, became apparent and knowledge of it more widely disseminated in printed books” (Richard H. Grove, *op. cit.* , p.51).

The conservation efforts initiated in the colonies were the result of a keen awareness that had developed about an impending global scarcity of timber resources. However, none of these efforts could be linked directly to any methodical efforts at organising the resource-use practices in the colonies to the objective of conservation. A serious threat to the supply of naval timber was the initial impetus for conservation. In the absence of any institutional evolution thus the environments of colonies continued to suffer.

Richard H. Grove has studied the conservation practices of English colonisers in his book *Green Imperialism*. He writes: “The very early incorporation of conservationism as an accepted part of the role of the colonial state in India needs to be set in a broader context. There is no doubt that environmental sensibilities in Britain, for example, were, among some groups, almost as well developed by the 1860s as they were among the scientific services in India. They were very different kinds of sensibilities, and were associated with different kinds of social critique. The biota of Europe was simply not perceived as being threatened by rapid ecological change of the kind that was taking place in India. As a result, embryonic worries about the destruction of rural landscapes and about species extinctions remained the concern of a largely ineffective minority” (pp. 462-3). It is not totally unfair to assume that environmental conservation as a policy was not on the principal agenda of the colonialists. Forest resource, as we shall see in Unit 20, was their major focus. The depleted wood resources back home in England were a blinker. It was not until the early years of twentieth century that serious attention was given to the issue.

18.4 SUMMARY

Colonial understanding of environment was guided by the process of industrialisation and the necessity of controlling resources available in the colonies. The main feature of this understanding was an emphasis on the use of natural resources as commodities. In this the local cohesive communities who had hitherto been sustaining on the natural resource were relegated into background and their place in was occupied by atomised individuals. A major consequence of this was that individual access, in place of community access, to resources was promoted. The natural resources were now oriented towards market and the subsistence pattern of resource-use was seriously ruptured. The conservation practices, taking into consideration the environment as a whole, had not come into vogue. India as a colony was seen as a repository of natural resources, the exploitation of which was seen as a legitimate right.

18.5 EXERCISES

- 1) How did industrialism shape the colonial perception of environment?
Discuss.
- 2) Did colonisation of India result in environmental degradation?
Comment.
- 3) Write a short note on the colonial conservation practices.

18.6 SUGGESTD READING

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

**Colonialism and
Environment**

Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1800*, Delhi, 1995.

Irfan Habib, *Essays in Indian History, Towards a Marxist Perception*, New Delhi, 1995.

Richard H. Grove, Vinita Damodaran, Satpal Sangwan, eds., *Nature & The Orient, The Environmental History of South and Southeast Asia*, Delhi, 1998.



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UNIT 19 ENVIRONMENTAL AGENDA

Structure

- 19.0 Introduction
- 19.1 Colonial Environmental Agenda
- 19.2 Post-colonial Situation
- 19.3 Summary
- 19.4 Exercises
- 19.5 Suggested Reading

19.0 INTRODUCTION

The environmental agenda of the colonial and the post-colonial period in India show a striking continuity in their working doctrine. This continuity is also reflected in the underlying principles of related policies. The early attention of the English colonisers was almost exclusively focused on timber among all the natural resources of India. The environmental agenda was therefore set by the English keeping in mind the forest and its products. The objective was abundantly clear- conversion and utilisation of forest timber as a commodity geared for the market. Interestingly, the forest policy pursued by independent India too was guided by a similar if not identical agenda. There is, however, a divergence of views on specific items of the forest policy of the English colonial powers in India as also the policy pursued by independent India. Since forest resources were invariably located at the centre of colonial interest zone, a discussion of the forest policy will help us understand the characteristics colonial environmental agenda. Similarly for the post-colonial period, the policy discussion mainly focuses on forests that help us portray the objectives of the policy.

19.1 COLONIAL ENVIRONMENTAL AGENDA

Reviewing the book *Nature and the Orient* in the *Economic and Political Weekly* (issue dated July 3-9,1999) David Hardiman had written that the forest agenda of the British colonial powers was subjected to a critical enquiry in the book by protagonists arguing for and against the forest policy adopted by the British. The arguments centered round the current crisis of massive deforestation and while the forest policy of the British colonial period was held responsible for originating the current crisis, it was also contended that the same policy continued to be implemented almost seamlessly in the post-colonial period. This actually was an extension of the position taken by Ramchandra Guha in his writings dating from early eighties (1973 and after). Guha's position was that "the British had established an autocratic forest department which sought to exploit timber for imperial needs by enclosing the forests and

excluding the peasantry from using them as a resource-base. This gave rise to disparate protests in the late 19th century and later nationalist-led forest protests of the Gandhian period. With no substantial changes after independence in 1947, the protests continued, giving rise in time to the Chipko movement. Guha was highly critical of the British, who in his account were blamed for both snatching the forests from the people and for providing the institutional base for their commercial exploitation” (Hardiman). This position was contested “by the British scholar Richard Grove, who sought to show that the original ‘greens’ in India were in fact colonial officials. Colonial forest policy was, in his view, rooted in an enlightened understanding of environmental issues developed in particular by a group of remarkable Scottish medicos serving in the colonies, who sought initially to understand the connection between climate and health, but very quickly became experts in botany and ecology. They argued that there was a close connection between deforestation and environmental desiccation, and pressed strongly for state-led conservation of forests. Through their pressure, the earlier laissez-faire attitude towards forests was replaced from the mid-19th century onwards by active management and control” (Hardiman).

It is evident from the positions taken by both the protagonists as well as the opponents that the colonial environmental agenda as reflected in the British forest policy in India was based on the premise that forest resources were valuable natural assets on which the state possessed absolute proprietary rights. The logical extension of this premise was that the communities exercising traditional rights over forests were not justified in their claims and should be de-legitimized from such claims in order to protect the forest. The details of the forest policy would make this point clear.

The process of extensive use of wood as a forest product had begun in England earlier than Industrial Revolution. But this process was hastened around mid-eighteenth century when use of charcoal was practiced on an extensive scale as fuel to run blast furnaces. By the third quarter of eighteenth century the forest situation was beginning to look grim as vast areas were denuded of all forest cover. Since the famous oak forests of England had been exploited to the extent that even their traces had begun to vanish, quality timber was an urgent requirement. The maritime expansion and wars among colonial powers for grabbing as large a slice in global wealth as one could manage had maintained a constant pressure on ship building industry. India as a colony was therefore a most opportune possession for England. One major pressure on English colonisers was for procuring timber for ship building. In this situation Indian teak was discovered as a product of quality and durability. The worth of Indian timber may be had from the general perception that England was saved in war with Napoleon due to a regular supply of teak timber from India. As stated by Gadgil and Guha, “in the early nineteenth century, and following its defeat of the Marathas, the East India Company razed to the ground teak plantations in Ratnagiri nurtured and grown by the legendary Maratha admiral Kanhoji Angre” (p. 118; cited from *Bombay Gazetteer*).

Another factor responsible for the exploitation of forest was the expansion of railways in India. A phase of laying railway lines all across India that began in the second half of nineteenth century needed a very large number of sleepers for providing the foundational base for placing the railway tracks on it. The sub-Himalayan forests of Garhwal and Kumaon were completely denuded. The destruction was also the consequence of a policy of felling trees without accurately estimating the requirement of sleepers. Large number of felled trees in fact rotted at the felling site itself. The volume of this destruction can be roughly gauged from the figure of 35000 trees needed annually to meet the Madras Presidency requirement of nearly 250000 sleepers. “The crisis had assumed major proportions” write Gadgil and Guha, “as only three Indian timbers –teak, sal, and deodar –were strong enough in their natural state to be utilised as railway sleepers. Sal and teak, being available near railway lines in peninsular India, were very heavily worked in the early years, necessitating expeditions to the north-western Himalaya in search of deodar forests. The deodar of the Sutlej and Yamuna valleys was rapidly exhausted in the years following the inception of the forest department – over 6,500,000 deodar sleepers were supplied from the Yamuna forests alone between 1869 and 1885” (p.122; citing G.P. Paul, *Felling Timber in the Himalaya*, Lahore, 1871 and N. Hearle, *Working Plan of the Tehri /Garhwal Leased Forests, Jaunsar Forest Division, Allahabad, 1888*).

Further, the orientation of the revenue policy of English colonial power also resulted in the destruction of forests. The objective was to increase cultivation and thus enhance the revenue collection of the State. Forests were then treated as unnecessary obstacles in the way of agricultural expansion.

The agenda of the English colonial power was clear as its main objective was to produce large commercial timber. The forests were ruthlessly subjected to this commercial aim. The other objective was to increase the volume of revenue collection. Forests were again treated with disdain as the act of agricultural expansion cleared large areas of all obstructionist wooded growth. In this scheme forest dwellers were to become great sufferers. A note reproduced from the *Bombay Gazette* by Satpal Sangwan describes this aspect vividly: “Here was one Bhugut at his literary best. He recaptured the emotions of the ‘Sons of the forests’ separated from their mother.

*By one direful stroke of pen the poor tribal finds himself at once a proscribed outcaste in his own wilds. His hills and jungles fastnesses are suddenly proclaimed to be state forests. Every vegetable and mineral substance therein is declared to be ‘forest produce’. All forest produce is declared to belong to the Crown. And no one is allowed to move any forest produce whatever without the formal permission of the ‘Jungle-walla sahib’, the new forest king. Does a wretched Varli scratch clean half an acre of slope and cover it with a layer of bushes and scrub, all ready to burn, down comes the forest guard and arrests him for committing waste! Does he lop a **kheir** or an **ain** tree, or any of the hundred and one kinds specially reserved, he is taken away to*

the magistrate for injuring Crown property. Does he cut a few reeds for his hut, or bamboos for his cattle shed, he is a thief for he has stolen public property. Does he collect a little store of mowha flowers, or korinda berries, or nuts or edible roots, or what not, –poor fool, he little knows that he is committing a crime, that mowha flowers and all other forest produce are no longer his, and that all property in them is transferred to the neighbouring Parsee or Hindu contractor! Of course he is fully informed –that all is done for his own good, that the mowha belongs to the Queen, that illicit distillation must be stopped, that intoxication is a great sin, which cannot be allowed under a moral British raj, etc.” (‘Making of a popular debate: The Indian Forester and the emerging agenda of state forestry in India, 1875-1904’ in *The Indian Economic and Social History Review*, 36, 2, 1999, p. 203).

19.2 POST-COLONIAL SITUATION

Analysing the colonial environmental policy, Gadgil and Guha made a pithy remark: “If in the neo-Europes, ecological imperialism paved the way for political consolidation, in India the causation ran the other way, their political victory equipping the British for an unprecedented intervention in the ecological and social fabric of Indian society. Moreover, by exposing their subjects to the seductions of the industrial economy and consumer society, the British ensured that the process of ecological change they initiated would continue, and indeed intensify, after they left India’s shores” (p.118).

In line with this remark the forest policy of independent India has truly continued the basic working concepts of its predecessor, the English colonial power. There are four operative areas where this feature is clearly manifest. A remarkable element of post-colonial forest policy has been its intimate links with wood-based industries and processed wood products. Perhaps for this purpose there has not taken place any change in the ownership of forests. The monopoly set up by the English over Indian forests and the usurpation of the sole right over its resources has continued unabated with only a change in the ownership from a colonial state to the post-colonial state.

The National Forest Policy, 1952 reiterates this monopolistic control by legitimising national priorities as of precedence over local priorities. The settlements on the fringes of forest lines are depossessed of claims over the neighbouring forest resources. The forests are declared a ‘national asset’ and state control declared as in the interest of the entire country. “The rationale for government ownership is the belief that private individuals and groups will not invest in tree crops whose gestation period often exceeds a lifetime” of the individual (*This Fissured Land*, p.194).

A second feature relates to the continuity of control over forests by technically trained managers. This immediately denies any role in the forest upkeep or management to the traditional local knowledge and practices. The pitfall is that resource use and resource management are segregated as mutually insular categories. Further the commercial

exploitation of forest continues even in independent India. The colonial orientation of forest as a revenue generating possession continues in the same manner in the post-colonial state. There is thus a tendency to over exploit the forest. As suggested by Gadgil and Guha, “A narrow commercial orientation is also reflected in research produced individual bibliographies for commercially valuable species such as teak, sal and chir pine, whereas the many varieties of oak, so crucial for sustaining Himalayan agriculture, only merited a single bibliography” (p.195).

Finally, the social groups which are intimately connected with forest do not seem to possess any long-term interest in the upkeep of forest resources. The situation is appalling in view of the fact that the forest management does not leave any scope for such social groups to benefit in any way from the forest resources. The “bureaucratic apparatus, with its diffusion of responsibility and lack of any accountability, provides no motivation to a good officer for the proper management of resources under his charge, or disincentives for those who mismanage” (*This Fissured Land*, p. 196).

19.3 SUMMARY

The colonial environmental agenda is most aptly reflected in the management policy of the English for forest resources. The denudation of forests in England forced them to reorient forest resource-use in India. Foremost change inflicted was in making forest resources a commodity for the market. This necessitated that various traditional claims on the forest were necessarily pushed aside. The communities sustaining on such resources were completely forbidden from exercising any user right or control over the forest. The demands of the maritime expansion and of navy were fulfilled by recklessly felling trees. Pitiably there was not much change in this situation in the post-colonial period. Commercial use of forest was at the top of the agenda and community exclusion was a logical corollary. The principles of management did not change and forest remained under the control of the state.

19.4 EXERCISES

- 1) Discuss the agenda of the English colonial power with regard to the forest resources of India.
- 2) The post-colonial forest policy was a blemish-free continuation of the colonial policy. Comment.

19.5 SUGGESTED READING

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

Richard Grove, Vinita Damodaran, Satpal Sangwan eds., *Nature and the Orient, The Environmental History of South and South East Asia*, Delhi, 1998.

UNIT 20 RESOURCE MANAGEMENT: FORESTS

Structure

20.0 Introduction

PART A

20.1 The Pre-Colonial Background

20.2 The Colonial Period

20.3 Post-Independence Period

20.4 Recent Debates

PART B

20.5 Forest Policies: A Politico-Legal Analysis

20.5.1 The Colonial Background

20.5.2 Independent India

20.6 Summary

20.7 Exercises

20.8 Suggested Reading

20.0 INTRODUCTION

The forest cover in our country has assumed an alarmingly low proportion. From a position of abundance in ancient times to a dismal state today, the long time span has been full of contradictions. Increased population pressure, expanding urbanisation, an ever-pressing need for good standards of living and development in industrial technology have long disturbed the harmonious relationship between the humanity and the greens. In all descriptions of forest resource-use, there has been a tendency to see the colonial rule as an ecological ‘watershed’: the colonial rule working hand in glove with the aggressive values of industrial capitalism did much damage to the native forests. Of late the proponents of the revisionist school have sought to question such stereotypical constructions citing regional evidences. What however goes undisputed is the fact that even if colonial rule, on some occasions, was not directly responsible for the decimation of forests it did create enabling conditions for the same.

In this Unit, we shall learn about the changing patterns of resource-utilisation embedded in the man-forest relationship over a period of time. This description will not only give us a holistic picture of utility patterns of forests as a resource but would also enable us to locate and identify factors and processes that brought about an element of incongruity in sustainable utilisation of the forest wealth. It would help us to comprehend the structure and impact of man’s activities on forests

over a period of time and discern the forces of continuity and change in the period under discussion. For the convenience of the learners the argument in the Unit is divided into two parts: the first part deals with the changing resource values of forests and the second part with the policies and legislations in accordance with the changing notions of resource exploitation.

PART A

20.1 THE PRE-COLONIAL BACKGROUND

In order to understand the dynamics and undercurrents of colonial impact on the understanding of forest as a resource, we need to understand the strands of human utilisation of the forests in the preceding period.

The period from about 500 BC to 300 AD saw a big advance of agricultural land over rich forest area both in the northern India and the river valley areas (for example Krishna, Godavari, Cauvery, Vaigai) in the peninsular India. Greater agriculture meant larger availability of surplus. Thus tribal chiefdoms started giving way to large states; Mauryas and Kushanas in northern India, the Chalukyas and Sangam Cholas in south India. The ground for further exploitation of forest resources lay in the logic of the empire building exercise. With technological limitations, the only viable alternative for enhancing surplus lay in bringing more land under cultivation. Of course trade was also coming up in a big way but then the ships and boats had to be built out of the forest wood. Another way out was incorporating other territories, which called for better weapons of war. Elephants assumed significance, and elephant forests started coming up. The number of towns increased and the houses came up that were made of wood. Moreover, timber had to be used for construction of furniture, carts, chariots, wooden bridges etc. The concept of 'hunting reserves' also came up, as hunting became a recreational activity. Chanakya says that Brahmanas should be provided forests for plantations, for religious learning and for performance of penance. We have seen earlier also that many philosophical treatises were written in the forests. *Upanishads* and *Aranyakas* were the major ones. The importance of forests is further borne out by the treatment it receives in Kautilya's *Arthashastra*. After the Mauryas, the other important empire builders were the Guptas. But during the Gupta times and more particularly later Gupta times economy began to collapse. There was a manifest decline in trade and towns and the use of monetary system. Inscriptions belonging to the period indicate a trend towards ruralisation of the economy and thus greater pressure on land and consequently on the forest. Amidst all these developments, the forest question lost its prominence and in the later sources lesser attention was given to the forests.

The Delhi Sultanate saw more demands being put up on the forests. The total population (both human and livestock) increased, as did the number of cities and towns. Consequently urban population also increased. All this led to a proportionate quantitative increase in the demand for fuel wood, fruits, food, fodder etc. Demand for quality timber for construction

of boats, bridges, houses, chariots, buildings, carts etc. also went up considerably. The Sultanate rulers did not come out with a positive policy of conservation though of course we see gardens being set up.

On the whole, however, the forest cover did not pose any major problem to the Delhi Sultanate. Though the demand for forest produce increased but the land- man ratio was still very favorable in the Indian context. Land was abundantly available and as such the problem of converting forestland into agricultural land was not so strong. Added to this was the factor of natural regeneration of the forests alive.

The importance of forest increased in Mughal India corresponding with increase in population and urbanisation. According to W.H. Moreland, Indian population at the death of Akbar in 1605 AD was 100 million while R.K. Mukherjee gives the figure of 130 million for the same years (1605AD). Together with the increase in general population, there was also a qualitative and quantitative growth of urban way of life. Thus added to the existing demand of food, fuel, fodder, there was a demand for timber particularly the superior variety. The forest of Bengal, Agra, Allahabad, Sind (Thatta), Lahore, the Western and Eastern Ghats supplied the raw material. Forests served another utilitarian purpose; the forest products formed an important component of the non-agrarian production during the Mughal period. As such the ruling class was keen to encourage the production of many forest products like timber, fruits, fodder, roots, barks, resins, herbs, production of lac, tanning of leather (babul tree), gumlac (red dye, sealing wax), mulberry silk etc. as discussed in Unit 13 of Block 4.

20.2 THE COLONIAL PERIOD

The colonial period saw a qualitative shift in the man-forest relationship for added to the Indian demands were now the demands of the British Raj.

With the advent of the colonial rule an element of conscious and ruthless exploitation begins to determine the man-forest relationship (The East India Company and later the Viceroy represented the interests of colonial forces). For the first time, the proceeds of forest exploitation accrued to an agency, which had no interest in the development of the Indian subcontinent. India was systematically converted into a colony serving the interest of the mother country. The British came to India as a trading nation. The gradual establishment of political hegemony together with development in the field of transport and communication, colonial trading practices and industrial revolution brought about substantial change in this relationship. Forests now came to be seen as resources to cater to the requirements of the expanding colonial political economy.

Indian teak featured as the permanent source of supply of durable timber for the British ship building industry. It saved England during the war with Napoleon and the later maritime explosion. Ships were built in dockyard in Surat and on the Malabar Coast as well as from teak imported

in to England. The thrust of agrarian policy of the colonial state also worked to the destruction of forests. Forests were considered 'as an obstruction to agriculture and consequently a bar to prosperity of the Empire'. To enhance the agrarian revenues, cultivation had to be extended; to extend cultivation forests had to be removed. This process was exacerbated with the development of railways after 1853. Major chunks of forest were destroyed to ensure the manufacture of railway sleepers. The sub- Himalayan forests of Garhwal and Kumaon were denuded to meet the early demand. Railways put other demand on forests as well. Before the Raniganj coalmines became operational, the forests also supplied the fuel requirements of the railways. The fuel wood requirements of the railways in the North West Provinces in the 1880's caused considerable deforestation in the Doab. Forests in Madras region suffered wanton destruction causing alternating cycles of flood and drought in the districts of North Arcot and Chingleput. Railway requirements, as has rightly been pointed out by many scholars, formed 'the first and by far for the most formidable' of the forces thinning the forest. Private contractors, both Indian and European, were chiefly responsible for the destruction of the forest cover; even the Indian princes came under their influence and sphere of activity. (Cf. *This Fissured Land*, Delhi, 1992, pp.188-33).

The forest policy of the colonial administration worked within the overall framework of the priorities of the imperial policy. One of the foremost priorities was to generate more and more revenues for a 'self-supporting' British rule. This logic suggested that forest products had to be marketed. The colonial rule made constant efforts to find markets for the multiple species of India's tropical forests. **Table 1** shows the surplus generated on the revenues from the sale of forest products.

Table 1: Revenue and Surplus of Forest Department 1869-1925

Yearly average for the period	Revenue (Rs. Million)	Surplus (Rs. Million)	Percent of column 3 to column 2
1869-70 to 1873-74	5.6	1.7	30
1874-75 to 1878-79	6.7	2.1	31
1879-80 to 1883-84	8.8	3.2	36
1884-85 to 1888-89	11.7	4.2	36
1889 -90 to 1893-94	15.9	7.3	46
1894-95 to 1898-99	17.7	7.9	45
1899-1900 to 1903-4	19.7	8.4	43
1904-1905 to 1908-9	25.7	11.6	45
1909-1910 to 1913-14	29.6	13.2	45
1914 -1915 to 1918-19	37.1	16.0	43
1919-1920 to 1923-4	55.2	18.5	34
1924 to 1925	56.7	21.3	38

(*Ibid.*, p.136; The source of the table has been cited as E.P. Stebbing, *The Forests of India*, Vols. III, London 1927, p.620)

Urban centers required forest products for fuel wood, furnitures, building timber etc. The Himalayan forests provided bamboo, sal and several species of conifer for the urban centers of Punjab and the United Provinces and for the military cantonments and hill stations. Apart from the teak export trade, trade in minor forest produce also picked up in the twentieth century. Resins, turpentine tanning materials essential oils and other associated non-timber forest products had a variety of industrial applications and foreign trade in such items showed a steady rise.

The massive importance of the forests reflected itself in other ways particularly during the two war periods. During the First World War, enormous amounts of timber and bamboo were exported to help British military operations in Egypt and Iraq. The Second World War was more devastating for Indian forests. India became the sole supplier of timber to Middle East and later to the Allied forces in Iraq and the Persian Gulf. **Table 2** gives an idea of the relative importance of the forests during the two wars.

Table 2: India's Forests and Second World War

Year	Outturn of timber and fuel (m. cuft)	Outturn of MFP (Rs. m)	Revenue of FD	Surplus of FD (Rs m)	Area sanctioned Under working Plans (sq. miles)
1937-38	270	11.9	-	—	62,532
1938-39	299	12.3	29.4*	7.2*	64,789
1939-40	294	12.1	32.0	7.5	64,976
1940-41	386	12.5	37.1	13.3	66,407
1941-42	310	12.7	46.2	19.4	66,583
1942-43	336	12.9	65.0	26.7	51,364
1943-44	374	15.5	101.5	44.4	50,474
1944-45	439	16.5	124.4	48.9	50,440

Note: * average for the period 1934-35 to 1938-39

MFP – Minor Forest Produce

FD – Forest Department

(*Ibid.*, p.140; Compiled from Indian Forest Statistics, 1939-40 to 1944-45, Delhi, 1949)

Any discussion on the colonial impact on the forest cannot be complete without mentioning one of its most obvious manifestations; the decimation of wildlife. From the middle of nineteenth century, a large-scale slaughter of animals was started by the British. Much of this shooting was motivated by the desire for large 'bags'. Many Indian princes also sought to emulate the shikar exploits of the British, Another related transformation during the colonial period was the deviation of forest lands for the development of tea, coffee and rubber plantations. In fact the state's desire to commercialise the forest went hand in hand with the allotment of vast tracts of forestlands to the planters. The development of road and railway networks to facilitate the export of tea, coffee and rubber hastened the process of deforestation. Besides, the plantation economy itself had a high level of timber demand for fuel and packaging.

The colonial state has been criticised on many other accounts as well. For decline in traditional methods of forest conservation, promotion of single species teak monoculture, socio-economic and cultural marginalisation of tribals and other forest dwellers – all went a long way in bringing in an element of incongruity between forest ‘preservation’ and human existence.

20.3 POST-INDEPENDENCE PERIOD

During the post independence period large tracts of forestland continued to be diverted to non-forest purposes in the name of ‘development’. Although this theme has been discussed in many accounts on forests, we shall only seek to familiarise ourselves with the nature of the problem. The phenomenal growth of population and urbanisation and the consequent extension of agriculture, construction activities, increasing industrial proliferation, mining and quarrying activities all took a massive toll on the forested areas. With the development of a large number of multipurpose projects and dams, thousands of acres of forestland were submerged. The villages and habitats of the tribals were also submerged due to impounding water in the reservoirs. The rehabilitation of the displaced also took place at the cost of neighboring forests. The politics of refugee rehabilitation also affected forest covers in many areas. The mushrooming of criminal gangs smugglers and timber mafia together with the increasing prices of timber has led to a ruthless denudation of forestland. In addition, forests have of late, also become a haven of many terrorist and insurgent groups. Many forests, in the North East, Jammu and Kashmir, the Terai, Andhra Pradesh have suffered due to these activities. Some of the conventional factors like forest-fires, over grazing, shifting cultivation, careless use of construction timber have had a devastating effect on forest acreage. Besides these certain other factors, neglected on account of playing a relatively small role in degradation of forest cover, have also to be taken into account. These include industrial emissions, air pollution and harmful effects of plant parasites, insects, fungi and wild animals. **Table 3** gives us a relative idea of diversion of forestlands for non-forest uses.

Table 3: Year-wise diversion of forest land for non-forest use

Year	Forest land diverted (in ha)
1980	Nil
1981	2672.04
1982	3246.54
1983	5702.01
1984	7837.59
1985	10608.07
1986	11963.11
1987	72780.05
1988	18765.35
1989	20365.05
Total	153939.81

Source: N C Saxena, *Forests, People and Profit*

According to some estimates, India is steadily losing about 15 lakh ha of good forestland annually. The number of trees that are felled annually could be almost equal to country's consumption of oil, coal and electricity put together. According to the State of Forest Report, 1995, which is the fifth assessment of the forest cover of India based on visual and digital interpretation of the satellite data pertaining to the period 1991-93, the total forest cover of the country is 639.600 sq. km., which is only 19.45% of the total geographical area of the country. Non-government estimate however differ on the question of the extent of the forest cover in the country and give a figure below even 19%. Clearly forests have suffered even after independence was achieved.

20.4 RECENT DEBATES

Madhav Gadgil and Ramchandra Guha, in *This Fissured Land: An Ecological History of India*, Delhi, 1992 lay down the basic premises of the recent debate. By portraying a rather romanticised notion of man-forest relationship, the authors say that despite the grave inequalities of caste and class, the pre-colonial Indian Society had a considerable degree of coherence and stability. This permitted a rapid turnover of ruling dynasties without major upheavals at the level of the village. The cultural traditions of prudence ensured the long-term viability of production and of the institution of caste, which was its central underpinning. Elaborating their argument, the authors take the position that in pre-colonial India, resource utilisation was in harmony with nature and resource sharing among various strata of the society was very cordial. The different claims of different resources in the caste system led to a state of equilibrium in turn providing the stability to the resource demand and supply. Caste was seen as consisting of endogamous groupings that were each marked by a particular economic activity and a particular ecological niche. The analysis of the various environmental movements have been explained in terms of disruption caused by the British as it argued that in pre-British time 'there was little or no interference with the customary use of forest and forest produce'.

There have been attempts to challenge the stereotypical portrayal of the villainous role played by British. It is argued that it was the 'colonial power' that initiated systematic forest conservation policy in colonies. *Nature and The Orient*, (eds. Richard H. Grove, Vinita Damodaran, Satpal Sangwan, Delhi, 1998) problematises the situation saying that it is an open question, however, as to whether the continuation of supposed customary land uses would have been more successful than the Company forest departments and their post-1857 successors in arresting deforestation for timber and arable cultivation. It is asserted that the evidence from other British colonies that developed forest departments at much later dates suggests that, without exclusionist forest reserve legislation, most surviving forms of 'common property management' would have faded away.

There seems to be a feeling that indigenous people were more responsible for the situation thus either they should have been trained to

modern knowledge or prohibited from those areas. Ravi S. Rajan ('Foresters and the politics of colonial agro ecology: The case of shifting cultivation and soil erosion, 1920-1950', *Studies in History*, Vol 14, No. 2 n.s. 1998) argues that the concerns for greater revenue appropriation (agricultural production) and the growing demand for wood led to 'conflict of interests'. Attempts were thus made to attain a balance between agriculture and forests; some lands were identified as suited for agricultural purposes while the marginal lands were to be developed as forests. The primacy of agriculture was thus quite evident. Antagonism between forest and agriculture was not simple as forest were considered necessary for good rains and at the same time it was believed that forest growth were harmful for ground-water as it sustained itself on the ground water only.

Scholars have also attempted to question the notion of a uniform British policy all across India and recent researches have pointed out that there were serious divergences of views on policies related with the forest/land/agriculture. Sivaramakrishnan ('Conservation and production in private forests: Bengal, 1864-1914', *Studies in History*, Vol 14, No. 2 n.s. 1998) tries to locate the debate in the context of the formulation of the Private Forest Bill in Bengal between 1865 and 1878. He tries to explore conflicting interests vis-a vis natural resources. There were several claimants and the state had to consider several probabilities before arriving at any formal policy. It was not only scientific knowledge (deforestation and desiccation) which contributed in the debate but various self interests also tried to appropriate the issue and mend the policy in one's favour. The underplay of various socio-economic interests and environmental concerns made the whole debate so complex that ultimately the bill could not be formatted.

The major issue involved in this debate was the property rights sanctioned by permanent settlement. These forests were often termed as *Jungle Mahal*, hence accepted as private property. Any attempt to withdraw or curtail the same would lead to greater resentment. This was the period when forests were much sought due to wood required for the railways. This resulted in greater deforestation, another cause of environment degradation. This has also been related with the problem of soil erosion. Although the tea-planters protested on the issue of deforestation as it caused less rainfall, their demand for more land for tea plantation in turn caused further deforestation.

Initially with the implementation of 'permanent settlement' British expected that marginal lands would also be put to better positive use as landlords will try to maximise the agricultural production on better lands and marginal lands shall be utilised for forests. However, it was not the case in eastern India, and later on, with the growing demand for wood we see a demand for a private forest policy to regulate the land-use. The issue became more controversial as the claims of *raiyyat* over the forest produces (which they argued were recognised by tradition) became an issue. The landlords on the other hand argued that it led to degradation in forest cover as also soil erosion. Conversion of private forests to

protected forests would lead to the denial of claims to *raiyat*. The problem further compounded as the demand of wood for railways increased. It became an issue of primacy of right to use – commercial exploitation was important or the traditional claims would take precedence.

Some scholars have also taken the debate into the realm of internal divisions with the colonial perspective. Ravi S. Rajan argues that the so-called colonial policy was not a monolithic structure and that there were quite evident heterogeneous views. He tries to explain the issue with respect to soil erosion and shifting cultivation by examining the deliberations at the Empire Forestry Conference.

The problem of conservation of forest- wild was of immense significance especially in the 1930s. The colonial policy differed on controlled silviculture with the help of shifting cultivation and abandoning cultivation as such. Examples from West Africa were cited to point out the benefits of shifting cultivation, but it was put aside by citing the nature of forests in India. The other related issue was the tussle between the foresters and scientific advisors. 'The political damage caused by shifting cultivation was its inducing nomadic habits on parts of the local population, discouraging agricultural progress and facilitating the evasion of taxes'. The problem caused by shifting cultivation was not only of tax evasion but the larger issue of timber trade\ supply to cater to the needs of British.

The problem of soil erosion on the one hand was caused by the cutting of forests for commercial use and on the other due to clearing of land for agricultural purposes. It was further fuelled by the ever-increasing population pressure and overgrazing. To tackle the problem, scientific studies were encouraged, but, 'given the social roots of the technological experts, it was asserted that the nature of their technical intervention was by no means value neutral'.

Another area of exploration has been the analysis of the various policies having a bearing on the environmental issues. Vasant Saberwal ('Science and the Desiccationist Discourse of the 20th Century', *Environment and History* 4, 3 (1997)) argues for the growing recognition within the academic ecological community of the complexities of ecosystem functioning and the limits to our predictive and explanatory capabilities with regard to large-scale ecological phenomenon. His explanation brings it out that the concerns for conservation evolved over a long period of time along with the growth in the scientific knowledge about environment. The need to examine the role of state in appropriation of scientific knowledge in support of its claims has been pointed out.

Ajai Skaria ('Being Jangali: The Politics of Wildness', *Studies in History*, Vol 14, No. 2 n.s. 1998, pp. 193-215; Also *Hybrid Histories: Forests, Frontiers and Wildness*, Delhi, 1998) highlights the general negligence of marginal areas and laments the importance of traditional issues. He tries to locate the problems of marginal issues in the context of politics

of growth. The same is very important for the construction of ideas such as jangali/tribal/primitive.

Skaria questions the notion whereby tribals were equated with 'wild' and 'primitive' and settled agriculture (under the patronage of state) with civilisation. 'What the British did not realise was that Baroda officials' attitudes were an acknowledgement of the political rather than criminal nature of the *dhad*, its connection with *giras* and shared sovereignties. So a *dhad* usually called not for retaliation but for a renegotiation of shared Sovereignty'. He also explores the various processes of mutual dependence between state and tribal polities. Revenue rights and authority were shared in a complex web of relationship where weakness of the either side was visible in the terms of resource sharing.

PART B

20.5 FOREST POLICIES: A POLITICO-LEGAL ANALYSIS

From a rich source of forest wealth in the pre-independence period, India has been reduced today to a position of minimal forest cover. Reckless exploitation coupled with absence of a comprehensive policy has led to a massive shrinkage in forest resource. As such, the need for a national policy governing all aspects of forest management becomes pertinent. The formulation of a 'suitable' forest policy began in the colonial period itself. From the establishment of the forest department in 1857 to the National Forest Policy, 1988, India has come a long way trying to cope with the problem of declining forest cover. We shall discuss this development in the following sub-sections.

20.5.1 The Colonial Background

Any discussion of the forest question in independent India cannot be complete without a description of colonial forest policies. Motivated ostensibly by exploitative reasons, the British laid the foundations of a forest policy in India. The ever-expanding British Empire was faced with a forest resource crunch. In a pre-industrial society like India, agriculture and forests had to bear the brunt of the burden. We have already discussed avenues of exploitation/colonial onslaught in detail in an earlier Section. In order to rationalise their unbridled exploitation as well as to appease the voices of opposition both within and outside the officialdom, the British took some measures that were given the shape of policy. Let us have a look at the major milestones in the evolution of forest policies under the British rule and in independent India.

- 1 **Establishment of the Forest Department:** Stating forest administration up to the 1857 rebellion a melancholy failure the Governor-General of India Lord Dalhousie called for the establishment of a department. The motive behind such a step was to ensure a sustained supply of timber for the railways. The Imperial Forest Department was formed

in 1865 and Dietrich Brandis, a German botanist was appointed as the first Inspector General of Forests.

- 1 **First Indian Forest Act 1865:** This act empowered the forest officials to issue local rules for conserving Indian Forests. Hurriedly drafted, this act was the first attempt by the state to assert its monopoly. It was primarily passed to facilitate the acquisition of those forest areas that had been earmarked for the railway supplies. It merely sought to establish the claims of the state to the forests it immediately required, subject to the provision, that existing rights were not abridged.

- 1 **Indian Forest Act 1878:** The forest act of 1865 had been drafted in a haphazard manner and thus had many shortcomings. Immediately after its enactment therefore the search began for a more comprehensive piece of legislation. A preliminary draft prepared by Brandis was circulated for discussion. A conference of forest officers was convened in 1875 to frame a new act. Three positions cropped up during the deliberations on the proposed act:
 - 1 The *annexationists* wanted total state control over all forest areas.
 - 1 The *pragmatists* argued for state management of ecologically sensitive and strategically valuable forests, allowing others to remain under communal systems of management.
 - 1 The third position often called the *populist* position completely rejected all forms of state intervention holding that tribals and peasants must exercise sovereign rights over woodland.

The matter was finally resolved in favour of the annexationists. The concrete proposals were embodied in Brandis' memorandum of 1875, which, together with Baden-Powel's paper (in the forest conference) formed the basis of 1878 Act. The Act cleared all confusions about the proprietary status of the forests and attempted to obliterate centuries old customary rights of the rural populations and forest dwellers.

It classified the forests into 3 categories:

- a) 'Reserved' Forest: In such forests, which were compact and connected to the towns, a legal separation of rights was aimed at. A permanent settlement either extinguished all private rights or transferred them elsewhere or in exceptional circumstances allowed their limited exercise.

- b) 'Protected' Forests: These were also controlled by the state. Here the rights were recorded but not settled. The state control was firmly maintained by outlining detailed provisions for the reservation of a particular tree species as and when they became commercially viable and for closing the forests whenever required for grazing and fuel wood collection.

- c) 'Village' Forests: The name itself explains this category. Such forest was under the control of the villages and were used by their inhabitants.

The new legislation greatly enhanced the punitive powers of the forest officials and prescribed a comprehensive set of penalties for violation of the act.

- 1 **Forest Policy 1894:** In 1894, the British government issued a circular which formed the basis of the future forest policy. Once again, while reiterating the propriety right of the state, the policy also sought to administer the forests for the benefit of the taxpayers and the people living in the vicinity of the forests. One very harsh feature of this policy was the fact that forest preservation was placed secondary to agriculture. It said “ wherever an effective demand for culturable land exists and can be supplied by forest area, the land should ordinarily be relinquished without hesitation”. Besides, a fourfold classification of forests was also made:
 - a) Forests (mainly on hill slopes), the preservation of which is important on physical and climatic grounds;
 - b) Forest, which afford a supply of valuable timbers for commercial purpose;
 - c) Minor forests, generally meant to meet the fuel, fodder, and timber requirements of the dependent communities;
 - d) Pasture lands, to cater to the needs of the local population.

Side by side the policy pronouncements, the government also tried to setup institutes to promote better utilisation of forest resources. Thus a forest school was established at Dehradun in 1878 for the training of forest rangers. This school received the status of a State Forest College in 1906 after which forest officers also began to receive training in India.

- 1 **Indian Forest Act of 1927:** This was the first comprehensive piece of legislation on forests under the British rule. Prior to its enactment the general law relating to forest in British India was contained in the Indian Forest Act 1878 and its amendments. It was an act to consolidate the law relating to the forests, the transit of forest produce and the duty leviable on timber and other forest produce. For the present purpose let us discuss some of the basis features of the 1927 Act.
 - a) It enhanced the powers of the state to create reserve forests, village forests and protected forests;
 - b) Provided state regulation of the timber and non-timber forest produce;
 - c) Prescribed penalties for the violation of the act;
 - d) Formalised the duties and powers of forest bureaucracy.

With some amendments in the subsequent years, the Indian Forest Act of 1927 continues to be operational even today.

The British forest policies were conditioned by utilitarian goals. Use

rather than conservation was the keynote of the colonial policy. Thus under the garb of promoting the interests of the people and the welfare of the nation what the British actually did was a ruthless exploitation of the forests. Extraction of timber, both quantitatively and qualitatively, was carried out mercilessly. Expansion of agriculture at the cost of forest cover was a blatant device to maximise revenue for the expanding empire. Further, the policies promulgated by them had several shortcomings. There was no provision for development of forest infrastructure or forest based industries. Unlike Industrial and Agricultural Commission, no commission was setup to promote the forest wealth. While the tribals and rural populations were divested of their customary rights no attempt was made to control or regulate the forests of the native states and the *zamindars*. Wildlife protection was never important for them. Forestry research and education however, was one aspect, which was taken up by the state but no follow up action was taken. It was never followed as a long-term positive policy resulting in an increase in the forest field. Even the recommendations of the Agricultural Commission of India (1928) for better management of the forest or Sir Herbet Howard (1944) were not adhered to.

20.5.2 Independent India

India inherited the colonial forest policy (1894) and the Indian Forest Act (1927). However circumstances had changed by then and the spatial and temporal context of the old legislations had been altered. Population had increased substantially and so had the attendant demands of fuel, food, fodder, timber etc. Urbanisation and industrial development had also increased as had the defence requirements. Added to this was the growing realisation of forest as essential to the physical and climatic balance of a country. This assumed particular importance in the context of two factors; firstly rapid deforestation during the two world wars by the colonial state and secondly the reckless exploitation of private forest by native states and *zamindars* during the last years of British rule. The situation called for a change in approach. Forests had to be brought in the realm of planned economic development. It was admitted by the planners that per capita forest area and per capita consumption of ground wood, pulp etc. was poor. A need therefore was felt for an increase in overall coverage and even regional distribution of forest. A change in approach was what was required. A chronological account of the efforts made in this direction follows.

- a) **Central Board of Forestry (1950):** The starting point of the new approach was the constitution of Central Board of Forestry (CBF) to guide the government in the formulation of various policies and programmes. This body became the supreme advisory body for the revision of the old forest policy. The meeting and recommendations of the Central Board resulted in the pronouncement of a new National Forest Policy on May 12, 1952.
- b) **National Forest Policy 1952:** The preamble of the National Forest Policy 1952 spelt out six supreme needs for the formulation of the policy.

- 1 Balanced and complementary land use;
- 1 Checking denudation in the mountainous regions, erosion along big rivers and invasion of the sea-lands on the coastal tracts;
- 1 Balanced physical and climatic conditions;
- 1 Supply of progressively increasing demands of grazing, firewood, small wood for agricultural implements;
- 1 Timber and other forest products for the requirements of defence, communication and the industry; and
- 1 Maximisation of annual revenue in perpetuity consistent with the fulfillment of the six vital needs.

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

- i) The new policy presented a functional clarification of the state/privately owned forest as follows.
 - Protected forests.
 - National forests.
 - Village forests, and
 - Tree lands

This classification was more comprehensive than the 1894 classification and had no relation whatsoever with the classification of Forests under the Indian Forest Act of 1927.

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

- vii) Called for a sustained supply of raw materials for forest-based industries and other associated enterprises like transport and defence. The importance of research arrangement in various branches of forestry and interaction between research institutions and industries was to be encouraged.
 - viii) Expressed the need to control private forests as well as to check grazing and shifting cultivation.
 - ix) Recommended proper forest legislation in the states and union territories of India where it had not been enacted and also analyzed the importance of awareness in the preservation of forests and education of forest officers and rangers.
 - x) Proper attention was to be paid to the preservation of rare fauna like lion' one horned rhino etc. As such sanctuaries and national parks were to be setup.
- c) **National Forest Policy, 1988:** The inadequacies and shortcomings of the 1952 policy coupled with the realisation that it had been unable to address the multifarious issues of independent India on a long term basis called for a revision in the existing forest policy. Indications of the necessity of a new approach were already coming.

The Estimates Committee (1968-69) of the Fourth Lok Sabha in its 76th report, expressed the opinion that a reappraisal of the National Forest Policy (1952) should be made by an adhoc body of experts in the light of experience gained during the years of development plans and the research and technologies advance made in the fields of forestry. Subsequently The National Commission on Agriculture (1976) advocated that there were two important points on which the National Forest Policy should rest:

- 1 Meeting the requirement of industrial wood for forest-based industries, defense, communications and other public purpose as well as fuel wood and fodder for the rural community; and
- 1 Meeting the present and future demands for protective and re-creative functions of forests.

The Commission thus sought to adopt a middle path between utilisation and preservation of forest wealth. It recommended:

- a) A change of strategy from a more conservation oriented forestry to a more dynamic programme of *production forestry*;
- b) The future production programme was to concentrate on clear felling of valuable mixed forests, mixed quality forest and inaccessible hardwood forests and planting these areas with suitable fast growing species yielding higher returns per unit area; and
- c) People's demands (mainly villagers and tribals) had to be accommodated in order to save forests. This it suggested was to be achieved through

social forestry on village and private lands or on growing trees on lands accessible to village people.

The next development was the passage of the Forest Conservation Act 1980. This act was a departure from the existing utilitarian forest policy as it aimed at conservation. For the first time, an act especially aimed at conservation was enacted in independent India. The basic objective of the act was to limit the power of the state governments to de-reserve forests or divert forestlands for non-forest purposes. Under the provisions of the Act, prior approval of the central government was required for diversion of forestlands for non-forest purposes. This act was amended in 1988 and some new provisions were added. In the meanwhile N.D. Tiwari Committee was constituted in February, 1980 to examine the adequacy of the existing administrative, legal and institutional arrangements for protecting environment. The committee noted that the commercial interests and the needs of the poor for essential fuel and fodder contributed to the denudation of forests and regulation. It thus recommended the inclusion of fuel and fodder supply in the Minimum Needs Programme.

Two years later in 1982 a Forest ministers' meeting was called. Two themes were retreated at the meeting — conservation for environmental and ecological needs and for preservation of wild life and genetic resources and development for rehabilitation of forests and wildlife, for enlarging the resource base through afforestation and social and farm forestry programmes. A meeting of the central board of Forestry held in 1987 was presided by prime minister and attended by chief ministers of different states. It was decided that

- 1 Forest lands would be used for preserving soil and water systems and not for generating state incomes;
- 1 All supplies to the market and industry would be met from farm forestry;
- 1 Small and marginal farmers would be especially encouraged to use their degraded lands for meeting commercial requirements.

The new forest was policy announced in December 1988 which was a marked departure from the 1952 National Forest Policy. Henceforth, forests were not to be exploited for industrial and other commercial purposes but were meant to conserve soil and environment and meet the subsistence requirements of the local people. The main features of the 1988 policy are:

- a) Maintenance of environmental stability through preservation and restoration of ecological balance;
- b) Conservation of natural heritage by preserving the natural forests and protecting the vast genetic resources for the benefit of the posterity;

- c) Meeting the basic needs of the people, especially fuel wood, fodder and small timber for the rural and tribal people;
- d) Maintaining the intrinsic relationship between forests and the tribal and other poor people living in and around forests by protecting their customary rights and concessions in the forests.

The implementation the policy was facilitated by the Government. of India by issuing a resolution on 1st June, 1990. *The June 1990 Guidelines* make it possible for the forest department to involve people in the management of forest.

20.6 SUMMARY

We have seen that basic texture of man-forest relationship underwent a massive change over a period of time. From a position where the forests were venerated and cared for, to one of conscious exploitation, things have changed dramatically. The fact that this indiscriminate exploitation still goes on is a thing to seriously ponder upon.

In spite of massive changes in scenario, our forests continue to be governed by a law enacted almost 75 years ago. Since 1927, our priorities and demands have changed just on the population pressure. Added to this are the inherent contradictions in our forest policies.

The constant need for suitable forest legislation has led to enactment of many acts and promulgation of many policies during the colonial and postcolonial period. The requirements of forest preservation have not been advanced completely even after the 1988 Forest policy.

20.7 EXERCISES

- 1) Write an essay on the forest resources and their management in Colonial India.
- 2) Summarise the views of the following about forest resources in about 200 words each:
 - i) Madhav Gadgil and Ramchandra Guha
 - ii) Ravi S. Rajan
 - iii) Ajai Skaria
- 3) Examine the main thrust of the following in about 300 words each:
 - i) Colonial forest policies
 - ii) National Forest Policy 1952

20.8 SUGGESTED READING

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

Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1800*, Delhi, 1995.

Richard H. Grove, Vinita Damodaran, Satpal Sangwan, eds., *Nature & The Orient, The Environmental History of South and Southeast Asia*, Delhi, 1998.

Ajai Skaria, *Hybrid Histories: Forests, Frontiers and Wilderness*, Delhi, 1988.



UNIT 21 RESOURCE MANAGEMENT: WATER

Structure

- 21.0 Introduction
- 21.1 Situating Water Resources: Colonial Period
- 21.2 The Contested Domain: State, Environment and Water Resources
- 21.3 Surface Water and Ground Water
- 21.4 Water Resources: Spatial and Temporal Variations
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21.0 INTRODUCTION

Water resources occupy an extremely important position in the environmental discourse both in history and in the contemporary period. It is such a paradox that the total availability of water on planet earth is so much that water had for long time been considered an inexhaustible natural resource, yet water scarcities are today staring the human civilization so starkly in its face that none would even imagine the bounty of nature with regard to water as a reality ever. World oceans cover about three fourth of earth's surface. The total amount of water on earth is about 1400 million cubic kilometre (m.cu.km.). However the proportion of fresh water in this expanse is very small. About 2.7 per cent of the total water available on the earth is fresh water of which about 75.2 percent lies frozen in Polar Regions and another 22.6 per cent is available as ground water. The rest is available in lakes, rivers, atmosphere, moisture, soil and vegetation. What is therefore effectively available for consumption by the living beings and for other uses is a small proportion of the quantity available in rivers, lakes and as ground water. According to World Health Organization (WHO), only 0.0075 per cent of all water is readily available for human consumption. And, yet we are unable to manage our water resources with any degree of rationality leave alone wisdom.

Freshwater is not only precious and scarce but also a finite resource, which is unevenly distributed. In Africa 40 per cent of the population is still without access to water, which is 20 per cent in Asia and 15 per cent in Latin America and the Caribbean region. The World Development Report, 1992 points out that the global renewable water resource can be roughly estimated at 41,000 cubic kilometers. India sustains about 17 per cent of world population with only 4.6 per cent of the total average runoff i.e. 1900 cu.km. Its availability in nature, though is highly uneven both spatially and temporally. India is one of the wettest countries of the world with an annual average rainfall of 117 cm over the plains— about one and a half times the annual average over the land areas of the globe taken together. This position is graphically illustrated by the following chart:

India's Water Profile (in Cu.Km.)

Annual Precipitation Volume (Including snowfall)	4000
Average Annual Potential flow in Rivers	1869
Per Capita Water Availability (1997)	1967
Estimated Utilizable Water Resources	1122
(a) Surface Water Resources	690 Cu.Km.
(b) Ground Water Resources	432 Cu.Km.

Source: Ministry of Water Resources, Government of India.

Given this position we propose to discuss the theme of water resource and its utilisation and management in this unit. It will use and incorporate information from the post-colonial period also to illustrate the current situation with regard to water resources in India.

21.1 SITUATING WATER RESOURCES: COLONIAL PERIOD

The evidence for the use of water resources by the earliest settled societies is sufficient to merit an analytical attention. We have examined a part of this evidence in Block 4 and composed descriptive information. We have seen that the practice of irrigation since the establishment of settled agriculture during the Indus Valley Civilization was an established feature. As agricultural development was the pillar of the economy, all large powerful empires paid special attention to development of irrigation systems. Early in history, during the Mauryan period, a big reservoir called Sudarshana was created at the foot of mount Girnar in Saurashtra for supporting irrigation in the semi-arid conditions of the place. In the south, perennial irrigation may have begun with the construction of the Grand Anicut by the Cholas as early as second century AD to utilise the water of the Kaveri River for agricultural purpose. Wherever the topography and terrain permitted, it became a practice in the region to impound the surface drainage water in tanks or reservoirs by raising dams/embankments across the flow channel.

The references relating to the use of water resources in the medieval period are as plentiful as for the earlier period. Rapid advances took place in the construction of inundation canals. Water was blocked by constructing bunds across streams. The Tughlaqs encouraged the digging of canals and Firuz Shah Tughlaq is considered to be the greatest canal builder before the nineteenth century. In south India too the situation was the same. Irrigation is said to have been one of the major reasons for the growth and expansion of the Vijayanagar Empire in the fifteenth century. The Mughals had known the importance of water as they promoted irrigation facilities by providing loans to farmers to install irrigational devices. Water is said to have played such an important role in the life of a city that Delhi was abandoned and rehabilitated seven times in search of abundant water resources. Shahjahanabad, the Mughal Capital was located along the riverbank keeping the factor of easily accessible water resources in view. It may be noted that, but for exceptional cases, most of the canal irrigation prior to the arrival of the British was of the diversionary nature. In the early nineteenth century, however, the colonial rule initiated a 'sharp break' in the technique by introducing perennial canal irrigation in several parts of the South Asian subcontinent.

The colonial interface with water resources began with the development of irrigation works — the renovation, improvement and extension of existing network. Soon afterwards was started what is known as the 'era of modern irrigation'. For the first time, permanent head works in the form of barrages and weirs were thrown across riverbeds and their waters diverted through intricate and extensive canal systems. These barrages and weirs were equipped with a series of shutters to regulate flows by impounding water during lean season and diverting it into canals and, on the reverse, the former could be flipped open to release waters during periods of the river's peak discharges. In effect, by flattening the river's variable flow regime at certain points along its course, irrigation was sought to be transformed from a seasonal to a perennial possibility. The ensuing period saw the construction of several large canal irrigation schemes like the Bari Doab Canal (1859), Godavari (1852), Ganges (1854), the Krishna (1855), the Sirhind (1889) climaxing with the grandest irrigation project of the colonial period – the Triple Canal Project (1916).

The recurrence of drought and famines during the second half of the nineteenth century also necessitated the development of irrigation works as a protection against the failure of crops. As irrigation works in low rainfall tracts were not considered likely to meet the productivity test, they had to be financed from current revenues. Significant protective works constructed during the period included the Betwa Canal, the Nira Left Bank Canal, the Gokak Canal, the Khaswad Tank and the Rushikulya Canal. The colonial irrigation policies were significantly influenced and reiterated by the famine and irrigation commissions. The First Famine Commission (1880) emphasized the need for direct state initiative in the development of irrigational works while the First Irrigation Commission (1901) recommended the renovation of several existing

defunct or dilapidated irrigation works while proposing new schemes. It drew up a 20-year plan envisaging a huge public expenditure to irrigate 2.6 million hectares of fields. Some storage works in the South, tank irrigation projects in Central and South India, and tube-well irrigation schemes in western Uttar Pradesh were also implemented.

The 1930s saw the implementation of a new hydraulic principle in India. Known as the Multi-Purpose River valley Development (MPRVD), the new model of water resource development was sculpted on the lines of the Tennessee Valley Association (TVA) in the post-depression United States. The new technique envisaged focusing upon the entire river basin instead of merely the channel. The intention was to train the river through a sequence of interconnected dams, reservoirs, and diversions from its catchment all the way to its estuary by 'harnessing' its waters simultaneously for navigation, irrigation, flood control, and power generation. Between 1943 and 1946, the colonial government approved plans to build MPRVD schemes on the Damodar, Mahanadi, and Kosi rivers, besides setting up the Central Water, Irrigation and Navigation Commission (CWINC) as a professional water bureaucracy for formulating and implementing other MPRVD schemes.

MPRVD schemes continued to remain the dominant strategy of water resource management in independent India. Multi-Purpose river projects looked the best solution as India engaged in planned economic activities to achieve self-reliance, foster economic development and improve the standard of living of its people. Some important projects were initiated such as the Damodar Valley Project. Completed in 1963 across the Sutlej River, Bhakra-Nangal Project was the joint venture of Punjab, Haryana and Rajasthan governments; built across the river Rihand (a tributary of Son River), the largest multi-purpose project of Uttar Pradesh, Rihand Dam Project was completed in 1966 with a cost of 375 million rupees; the Hirakud Project involved construction of three dams across Mahanadi at Hirakud, Tikarpara and Naraj; The Chambal Project was a joint venture of the Rajasthan and Madhya Pradesh state governments; the Kosi Project was the result of a joint agreement between the governments of Bihar (India) and Nepal in 1954. Its main objective was to construct a barrage near Hanuman Nagar in Nepal along both banks of the river; the Tungabhadra Project was a joint undertaking of the governments of Karnataka and Andhra Pradesh; the Nagarjuna Sagar project was another of the same type. The harness of water resources on a large scale had become the priority of the state policy.

21.2 THE CONTESTED DOMAIN: STATE, ENVIRONMENT AND WATER RESOURCES

The themes of water, community, state and environment form an integral part of the contemporary discourse on environment and are rooted in the current politics of development. As David Mosse says at least two major political and policy positions currently shape questions around

water resources and their development in India. Both narratives invoke polarized notions of state and the community and both emphasise and find justification in the existence of long-term, successful, indigenous community managed irrigation systems, conceptualised as a counterpart to resource management by the state. The first is the critique of the modernising development strategies of the centralised state and the dominance of western technical perspectives on the irrigation and water resources over those of the indigenous community; a critique sharply focused in recent years by the controversy over large dams, the Sardar Sarovar in particular, but which in India derives from the visions of Gandhi and his followers. The second is a reformist policy arguing for devolution of irrigation management responsibilities from the state to the community of users, which forms a part of the international consensus on public sector reform underpinned by ideologies of privatisation, free-state, and a reduced role for the development state.

The relationship between state and resource management has often been explained in terms of a linear grand or mega narrative. The dominant thrust of such overarching explanation known as a 'standard environmental narrative' or 'new-traditionalist' discourse puts all the blame on the state. According to such narratives, the pre-colonial India is seen as a period of 'harmonious' and sustainable resource management. Colonialism is seen as the 'breaking-point' and it is argued that the intervention of the state, particularly the colonial state and the attendant revenue and proprietary rights regime, played havoc with common resources leading to the demise of village traditions of sustainable resource use. The process was accelerated by the post-colonial forms of government. The dichotomies of community/state, pre-colonial/colonial, tradition/modernity, and indigenous/foreign are extremely polarized in the traditional narratives.

In their search for a grand causal theory, the environmental protagonists of water resources extend the 'standard environmental narrative' to highlight what they consider as the breaking point in traditional water management systems. Modeled on the lines of Mahatma Gandhi's environmentalism, the classic argument comes from the authors of *Dying Wisdom* (Anil Agarwal and Sunita Narain, *Dying Wisdom: Rise, Fall and Potential of India's Traditional Water Harvesting Systems*, New Delhi, 1997). Accordingly Indian water harvesting systems are represented as rooted in a pre-colonial 'organic village economy' wherein the autonomous 'village republics' were the primary locus of management of natural resources and economic and political affairs. With the rise of the state control over common water resources, there was an 'erosion of the autonomous functioning of village management systems'. Colonial rule converted village common property into state property, denied customary rights and weakened traditional village authority transforming managed commons into degraded free access resources; it placed the decentralised village water systems under the control of centralised bureaucracies which prioritised modern engineering knowledge, large-scale irrigation and the expansion of commercial agriculture neglecting indigenous skills. On the other hand, punitive colonial revenue regimes

impoverished the peasantry and undermined the local financial base of water harvesting systems. This dismal state of India's traditional water harvesting systems only worsened with the 'arrogance of the post-Independence Indian political leadership and the irrigation bureaucracy' which preferred Nehru's vision of independent India with large dams as temples to Gandhi's vision of independent India founded upon its village heritage. It also calls for the revival of community control and traditional water harvesting systems. There is therefore a need for serious investment in research and development of traditional water harvesting systems through integrated and participatory renovation of tanks and the deforestation of catchments, drawing on indigenous knowledge of water-land relationships and involving all sections of community.

The relationships between the state and the community were more complex and problematic than has been made out to be in traditional accounts. David Mosse points out in his study of statecraft, ecology and collective action in South India that the impact of colonial governance on the water commons defies a simple representation and has more to do with changing systems of state than the erosion of village tradition. Indeed, traditional village water management system proves extremely elusive, and identification of the moment of their collapse is an impossible task involving a seemingly endless journey back in the time. Thus the decisive moment of a loss can be variously located in:

- i) the present government's neglect of indigenous knowledge and traditions;
- ii) the 1960s-70s green revolution expansion of capitalist agriculture and ground water irrigation;
- iii) changes brought about in the 1950s following Independence (for example, the abolition of Zamindari estate and establishment of structures of local government);
- iv) the colonial commercialisation of dry land agriculture in the late 19th and 20th centuries ;
- v) the centralisation of the colonial government and the building of technocratic irrigation bureaucracy from the 1850s ;
- vi) the consolidation of British power, its revenue systems and property law by the 1840s;
- vii) the dismantling of the south Indian old regimes around 1800;
- viii) the wars of the immediate pre-colonial period of the 1790s;
- ix) the neglect of decentralised systems under the Mughal rule during the 18th century;
- x) the disruption generated by the rise of the Vijayanagar empire in south India after 1350; and
- xi) the collapse of the Chola empire and its system of locality and village government.

21.3 SURFACE WATER AND GROUND WATER

The annual precipitation including snowfall, which is the main source of the water in the country is estimated to be of the order of 4000 cu.km. According to the National water Policy, 2002 (**Appendix 1**) as per the latest estimate (1993), out of a total precipitation (including snowfall) of around 4000 billion cu.m in the country, the availability from surface water and worthy-of-replenishment ground water is put at 1869 billion cu.m based on basin wise estimates of Central Water Commission. Due to various constraints of topography and uneven distribution of resource over space and time, it has been estimated that of 1869 cu.km., only about 1122 cu.km. can be put to beneficial use. From this nearly 690 cu. km. shall be due to surface water resources. The availability of water is highly uneven in time and space. Precipitation is confined only to monsoon months every year varying from 100 mm in Rajasthan to over 10000 mm at Cherrapunji in Meghalaya. Rivers and underground water aquifers often cut across state boundaries. Based on 1991 Census, the per capita availability of water works out to **220 cu.m.**

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

Basin-wise Surface Water Potential of India (Cubic Km/Year)

Sl. No	Name of the River Basin	Average annual potential in river
1.	Indus (up to Border)	73.31
2.	a) Ganga	525.02
	b) Brahmaputra Barak & Others	585.60
3.	Godavari	110.54
4.	Krishna	78.12
5.	Cauvery	21.36
6.	Pennar	6.32
7.	East Flowing Rivers Between Mahanadi & Pennar	22.52
8.	East Flowing Rivers Between Pennar and Kanyakumari	16.46
9.	Mahanadi	66.88
10.	Brahmani & Baitarni	28.48
11.	Subernarekha	12.37
12.	Sabarmati	3.81
13.	Mahi	11.02
14.	West Flowing Rivers of Kutch, Sabarmati including Luni	15.10
15.	Narmada	45.64
16.	Tapi	14.88
17.	West Flowing Rivers from Tapi to Tadri	87.41
18.	West Flowing Rivers from Tadri to Kanyakumari	113.53
19.	Area of Inland drainage in Rajasthan desert	NEGLIGIBLE
20.	Minor River Basins Drainage into Bangladesh & Burma	31.00
	Total	1869.35

Source: Ministry of Water Resources, Government of India.

Inland water resources of the country can be classified as rivers and canals; reservoirs; tanks and ponds; jheels, oxbow lakes, derelict water; and brackish water. K L Rao points out that the total quantity of water annually carried by the rivers of the country is about 16,45,000 million cu.m.

Of the rivers and canals, Uttar Pradesh occupies the first place with the total length of 31.2 thousand km, followed by Jammu & Kashmir and Madhya Pradesh. The next in the order of geographical coverage of inland water bodies are the tanks and ponds occupying 2.9 m.ha. and then come the reservoirs covering 2.1 m.ha. Most of the area under tanks and ponds lies in southern states of Andhra Pradesh, Karnataka and Tamil Nadu. Along with West Bengal, Rajasthan and Uttar Pradesh, these states account for 62 per cent of total area under tanks and ponds in the country. As far as reservoirs are concerned, major states like Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Uttar Pradesh account for a larger portion of area under reservoirs. More than 77 per cent of area under jheels, oxbow lakes and derelict water lies in the states of Orissa, Uttar Pradesh and Assam. Orissa ranks first in relation to the availability of brackish water followed by Gujarat, Kerala and West Bengal.

The importance of groundwater as a source for meeting drinking, industrial and irrigation requirements for an ever-increasing population cannot be denied. It caters to around 50 per cent of the total irrigation in the country. India has a vast area for ground water resources. Around 22 per cent of India's rainfall percolates under the ground. Of this total, about 430 billion cu.m reaches up to the upper surface of the soil. Nearly 384 billion cu.m reaches the pervious strata, which can be obtained by digging wells. According to a rough estimate the total ground water reserve at a depth of 300 m is 3700 m ham. This is almost 10 times the annual rainfall. The Central Ground Water Board (CGWB) estimates the annual exploitable potential at 42.3 m ham of which less than 1/4 is presently being exploited. In terms of exploitation of ground water potential Punjab comes on the top (93.85 per cent), followed by Haryana (83.88 per cent), Tamil Nadu (60.44 per cent), Rajasthan (50.63 per cent), Gujarat (41.45 per cent), Uttar Pradesh (37.67 per cent), Maharashtra (30.39 per cent), West Bengal (24.18 per cent), and Andhra Pradesh (23.63 per cent). States like Assam, Bihar, Madhya Pradesh, and Orissa have not been able to utilize even one-fifth of their total ground water potential.

Basin-wise Ground Water Potential of Country (*Cubic Km/Year*)

Sl. No.	Name of Basin	Total Replenishable Ground Water Resources
1.	Brahmai with Baitarni	4.05
2.	Brahmaputra	26.55
3.	Cambai Composite	7.19
4.	Cauvery	12.30
5.	Ganga	170.99
6.	Godavari	40.65
7.	Indus	26.49
8.	Krishna	26.41
9.	Kutch & Saurashtra Composite	11.23
10.	Madras and South Tamil Nadu	18.22
11.	Mahanadi	16.46
12.	Meghna	8.52
13.	Narmada	10.83
14.	Northeast Composite	18.84
15.	Pennar	4.93
16.	Subarnrekha	1.82
17.	Tapi	8.27
18.	Western Ghat	17.69
	Total	431.42

Source: Ministry of Water Resources, Government of India.

Although the ground water is a resource that can be replenished annually, its availability is non-uniform in space and time. A wide range of factors; climatic conditions, relief (topography), geological structure and local hydrological conditions control the ground water occurrence and movement. No precise techniques are available for assessment of recharge and discharge therefore the methods employed for ground water resource estimation are all indirect. Ground water being a dynamic and replenishable resource is generally estimated based on the component of annual recharge, which could be developed by means of suitable ground water structures. An understanding of the behaviour and characteristics of the water bearing rock formation known as aquifer is crucial for the quantification of ground water resources. An aquifer has two main functions — (i) to transit water (conduit function) and (ii) to store it (storage function). The ground water resources in unconfined aquifers can be classified as static and dynamic. The static resources can be defined as the amount of ground water available in the permeable portion of the aquifer below the zone of water level fluctuation. The dynamic resources can be defined as the amount of ground water available in the zone of water level fluctuation. The replenishable ground water resource

is essentially a dynamic resource, which is replenished annually or periodically by precipitation, irrigation return flow, canal seepage, tank seepage, influent seepage, etc. The methodologies adopted for computing ground water resources, are generally based on the hydrological budget techniques. The hydrologic equation for ground water regime is a specialised form of water balance equation that requires quantification of the items of inflow to and outflow from a ground water reservoir, as well as of changes in storage there in.

The main problems associated with the unscientific and unregulated development of groundwater are the over-exploitation of the resource leading to a fall in water levels causing failure of wells/tube wells; or deepening of the structure resulting in higher cost of pumping, seepage from sewer systems, industrial and urban waste disposal sites etc., and landward movement of sea water/fresh water interface in the coastal aquifers. Excessive withdrawal of water from the coastal aquifers has resulted in the landward movement of sea water/fresh water interface in some areas of Tamil Nadu and Saurashtra region.

For an effective water security system, it is imperative to take steps for augmentation of ground water storage through artificial recharge concurrent with the measures for development of the resource. The CWGB has carried out a number of artificial recharge and ground water conservation studies to develop the methodologies and technologies and to assess the economic viability of these measures. These studies conducted in Gujarat, Maharashtra and Tamil Nadu have established the feasibility of various recharge measures such as spreading, recharge through injection wells and induced recharge from surface water bodies and conservation of sub-surface flows through construction of sub-surface dykes. Percolation tanks have been found to be particularly effective in checking the surface runoff during the monsoons and conserving the same water recharging the underlying aquifers. Pilot projects have been carried out by CWGB in Karnataka, Maharashtra, Delhi and Chandigarh in this regard. Efforts have also been made to intercept and recharge the rooftop runoff during the rainy season by encouraging the installation of simple water harvesting systems.

There is however a need for suitable legislation to control and regulate various aspects related to the utilisation and development of ground water. The Ministry of Water Resources, Government of India has prepared a model bill in this regard. Known as the **Model Bill to Regulate and Control the Development and Management of Ground Water (2005)**, its provisions include the establishment of a ground water authority, powers to notify areas to regulate and control the development and management of ground water, grant of permits, registration of users, penalties for offences, efforts at promoting rain water harvesting etc. (**Appendix 2**).

21.4 WATER-RESOURCES: SPATIAL AND TEMPORAL VARIATIONS

- 1 Rajasthan, which accounts for almost 8 per cent of India's population, is endowed with only 1 per cent of the country's water resource.
- 1 The annual average runoff per capita in the country varies between 18147 cu.m in the Brahmaputra basin and 631 cu.m. in the west-flowing rivers of Kutch and Saurashtra to 411 cu.m. in the east flowing rivers from Pennar to Kanyakumari in the south.
- 1 About 80 to 90 per cent of the annual rainfall occurs during the four monsoon months (June to September) every year. For six to eight months of the year, the rainfall is either scanty or nil over most parts of the country.
- 1 Rainfall in India shows unequal geographical distribution and the frequent departures from the normal. It generally exceeds 1000 mm in areas to the East of Longitude 78 degree E to 2500 mm along almost the entire West Coast and Western Ghats and over most of Assam and sub-Himalayan West Bengal. On the west of the line joining Porbandar and Delhi and thence to Ferozpur, the rainfall diminishes rapidly from 500 mm to less than 150 mm in the extreme west. The peninsular region has large areas of rainfall less than 600 mm with pockets of even 500 mm.
- 1 Of the major rivers, the Ganga – Brahmaputra - Meghana system is the biggest system with a catchment area measuring nearly 110 m.ha, which is more than 43 per cent of the catchment area of all the major rivers in the country. The other major rivers with catchment area more than 10 m.ha are Indus (32.1 m.ha.), Godavari (31.3 m.ha.), Krishna, (25.9 m.ha.) and Mahanadi (14.2 m.ha).
- 1 As against the national per capita annual availability of water of 2208 cu. m., the average availability in Brahmaputra and Barak is as high as 16589 cu m. while it is as low as 360 cu.m. in the Sabarmati basin.
- 1 The total area of inland water resources is unevenly distributed over the country with five states namely Orissa, Andhra Pradesh, Gujarat, Karnataka and West Bengal accounting for more than half of the country's inland water bodies.

21.5 CURRENT ISSUES

The water resource management in India is today faced with some important issues. We must address them in order to understand the underlying conceptual operatives and also to find a way out from the impending impasse that threatens to make water resources the most contested and bitterly disputed matter. A list of such issues may be formed as below:

- 1 Inter-State Water Disputes
- 1 Inter-Linking Rivers: The National Water Grid
- 1 Big Dams versus Small Dams
- 1 Flood Control versus Flood Management
- 1 Water Pollution

21.5.1 Inter-State Water Disputes

Most of the major rivers in India are inter-state in character; having catchments/ water sheds in two or more states. Often, water disputes arise amongst the basin states with regard to the use, distribution or control of the waters in respect of many inter-state rivers or river valleys or in the interpretation and implementation of the terms of any agreement relating to the use, distribution or control of such waters or in the levy of any water rate in contravention of various prohibitions. During the British period, inter-state disputes were settled by the central government. Upon adopting a constitution the Republic of India made irrigation a state subject. The state governments could now exercise control over planning, development, regulation, and distribution of water flowing through their territories. Over a period of time certain legislations have been enacted which enable the central government to intervene in matters of inter-state dispute. According to the Water Dispute Act, 1956, the central government can constitute a tribunal for the settlement of an inter-state water dispute when a request is received from a state government. The River Board Act, 1956 authorizes the central government to constitute river boards in consultation with the state governments for regulation and development of inter-state rivers. The Government of India formed rules on 30 June, 1959 to settle inter-state water disputes. By the Inter-state Water Dispute Act, 1968, the central government has been given the responsibility of regulation and development of inter-state rivers to the extent to which such regulation and development under the control of the Union is declared by the Parliament by law to be expedient in the public interest. Above all, under Article 262 of the Constitution, the Parliament is empowered to provide for the adjudication or control of the water of any inter-state river. The following chart gives a preliminary idea of the inter-state river water disputes:

River in Question	States Involved
Kaveri	Karnataka, Kerala and Tamil Nadu
Krishna	Maharashtra, Karnataka and Tamil Nadu
Tungabhadra	Andhra Pradesh and Karnataka
Godavari	Maharashtra, Andhra Pradesh, Madhya Pradesh, Karnataka and Orissa
Narmada	Gujarat, Madhya Pradesh, Maharashtra and Rajasthan
Mahi	Gujarat, Rajasthan and Madhya Pradesh

Ravi and Beas	Punjab, Haryana, Rajasthan, Delhi, Jammu and Kashmir
Yamuna	Uttar Pradesh, Haryana, Himachal Pradesh, Punjab, Rajasthan, Madhya Pradesh and Delhi
Karmanasa	Uttar Pradesh and Bihar
Barak	Assam and Manipur
Mandvi	Goa and Karnataka
Mahadeyi	Maharashtra, Goa and Karnataka
Bhavani	Tamil Nadu and Kerala
Indravati	Orissa and Chhattisgarh

The central government has set up five Inter-State Water Disputes Tribunals so far, namely: Godavari Water Disputes Tribunal (April, 1969); Krishna Water Disputes Tribunal (April, 1969); Narmada Water Disputes Tribunal (October, 1969); Ravi and Beas Waters Tribunal (April, 1986); and Cauvery Water Disputes Tribunal (June, 1990). While the first three tribunals have already given their final awards, the remaining two tribunals are still adjudicating the issues referred to them. Most of the inter-state water disputes have been settled on the basis of equitable apportionment, which is the universally accepted principle. In addition, India also has some disputes with neighbouring countries like Nepal, Bangladesh, China over sharing of river waters.

21.5.2 Inter-Linking Rivers: The National Water Grid

It was in the middle of the nineteenth century that schemes for linking the rivers of entire Indian sub-continent were first planned. Since then almost a century passed before a similar idea was proposed again. In 1960s, K.L.Rao the Union Minister of State for Power and Irrigation spoke about the Ganga-Cauvery Link Canal. Later in the seventies, he developed the plans for a national water grid, which would transfer the surplus waters of the Ganges and Brahmaputra to the parched regions of central and southern states. The main Ganga-Cauvery link was to be composed of a canal 2640 km long. In the meantime Captain Dastur had proposed a similar idea. Popularly known as the 'Garland Canal', the project envisaged a 4200 km long 300 m wide Himalayan Canal aligned along the southern slopes of the mountain range and another 9300 km Central and Southern Garland Canal. Both these canals were to be linked at Delhi and Patna. In 1982, the Government of India formed the National Water Development Agency (NWDA) to identify river links for a national grid, to prepare feasibility studies and to execute detailed project reports. NWDA has in the last two decades identified a possible 30 river links, which would connect every major river in the Indian mainland and has prepared feasibility reports on six of these. It estimates that the cost of the entire project would be 5.6 lakh crores and would take 30 years to execute. The issue came alive again in 2002 when, following a directive from the Supreme Court, the Government of India set up a task force to prepare and outline an action plan for implementing a project to link the rivers of India and the Prime Minister declared that the task would be

taken up on a war footing. Critics have pointed out many issues that crop up with this grand plan:

- 1 It is said that the plan tantamounts to altering nature and redrawing the geography of the country.
- 1 Questions have also been raised on the technical feasibilities of the plan. The concept of transferring water from surplus source basins hinges on the availability of surplus in source basins. It has been pointed out that surplus water in source basins might not always be true in India. According to the internationally accepted definitions, eight of the twenty basins of India are water-scarce today and by 2025 (when the water grid is expected to be fully functional) thirteen river basins will be below the water-scarcity level. It is also argued that all the basins will qualify as water stressed, with the exception of Brahmaputra-Barak system.
- 1 Where would the funds for the plan come from? The estimated cost of 112 million is more than India's outstanding external debt and the Task Force (on Inter-Linking) has not indicated how and from where the funds would come. All over the world, inter-basin transfers have proved to be the most expensive option to develop water next only to sea-water desalinisation. Raising the funds would be a big constraint and the cost overruns would make the project prohibitively costly.
- 1 The environmental cost of the inter-basin transfer is another factor to be taken into account. It has been argued by hydrologists and ecologists that as opposed to being merely moving masses of water out to be regulated and dammed, rivers are fluvial regimes with complex geomorphologic, chemical and biological processes in motion. They are made up of a wide variety of aquatic and riparian species. Rivers with highly altered and regulated flows lose their ability to support natural processes. Experience from the U.S. (California), Israel, and former Soviet Union indicates high environmental costs of inter-basin transfer.
- 1 Water transfers can be made only with the consent of the states concerned. The NWDA assessment that surpluses are available in the Mahanadi and the Godavari is not shared by Orissa and Andhra Pradesh. Apart from the techno-economic feasibility, on which the Ganga-Cauvery link idea was abandoned earlier, the diversion of Ganga water would have international implications. In view of some water issues with our neighbouring countries, Bangladesh and Nepal, it is not likely that they would take this very kindly. The following chart illustrates some of the promises and pitfalls of the planned inter-basin transfer:

Promises	Pitfalls
Transfer 173 billion cubic meters of water to water-stressed regions.	More inter-state water disputes; diplomatic row with Bangladesh and Nepal.
Building 11,000 km of canal network.	Increased incidence of water-logging and submergence of 19292 ha of forests.
Generate 34,000 MW of power.	Raising funds a constraint; cost overrun to make the project prohibitively costly.
Boost GDP growth by 4 percent.	4.5 lakh people to be displaced

Source: The Hindu Survey of Environment, 2003.

It has been suggested that the feasibility of inter-basin transfers should be examined for contiguous basins, on a case-by-case basis unlike the current National Water Grid project which is an “all-or-nothing” linking of major river systems. People-centered sustainable local solutions have been posed as the more viable alternatives. Community efforts at harvesting rainwater and recharging the aquifers have been a major success in Alwar. Its success has revived the Arvari River which had not flown in the last forty years. Similar district and watershed-level experiences from Maharashtra, Madhya Pradesh and Andhra Pradesh hint at the potential possibilities of community based and participatory water management.

21.5.3 Big Dams versus Small Dams

India has around 4300 dams of which 2256 were built in a peak period between 1971 and 1990. Around three-quarters of the completed dams are situated in three western agricultural states. The large dams in India are constructed and owned by state governments. However droughts in recent years have raised some very vital questions regarding big dams. The supporters of large dam projects argue that:

- 1 dams confer many benefits and without them, the growing needs of food, water and energy cannot be met and any harm they may cause can be anticipated and remedied;
- 1 some of the adverse consequences attributed to the dams really arise from certain ‘political economy’ factors prevalent in the country; and
- 1 small dams, local watershed development, and water harvesting etc. are no substitute for large dams- they are complimentary measures that can meet only a small part of the overall requirements.

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

- 1 benefits, supposedly coming from many dams are overstated and the cost understated;

- 1 impact and consequences are rarely assessed in advance and cannot be fully foreseen, much less remedied; many adverse effects are irreparable;
- 1 needs of the future can be met without recourse to large dams, through smaller structures and demand side management.

The central question is whether the price of environmental damage and social disruption of indigenous and other communities is worth the ostensible benefits of providing water and power. The debate has become increasingly heated and has assumed the shape of a broader conflict between top-down, technocratic, and interventionist approaches to development and bottom-up, participatory and locally appropriate alternatives. The debate in India has been exemplified by a number of protest movements against big dams, the most well known being the Narmada Bachao Andolan. The nature of the conflict is even reflected in Government of India's rejection of the report on the World Commission on Dams (WCD) on the grounds that it was incompatible with country's development priorities. While acknowledging the fact that the dams have made a big contribution to human development, the WCD report indicated that the same had been accompanied in many cases by unacceptable social and environmental costs. In the last few years there has been an intense debate in India over alternative modes of storage (like tanks, small and medium sized dams) and in-situ capture through integrated watershed development and rainwater harvesting. The process has received a boost by numerous case studies of successful revitalisation of traditional collective water management systems and local level participatory management systems involving community mobilisation.

21.5.4 Flood Control versus Flood Management

Even after adding 16,199 kms of new embankments during 1954-1993 and spending crores of rupees on flood detention reservoirs, the area liable to floods in India has actually shown an increase. From roughly 19 million hectares in 1953, the flood prone area increased to 40 million-60 million hectares based on the different estimates. The trend has therefore been upwards. The expenditure on flood control has also been on the rise in the post-independence period from Rs. 13.21 crores in the First Plan to a high of 1691.68 crores in the Eighth Plan. India in fact remains the most flood-affected country in the world after Bangladesh. The massive infrastructure of storage reservoirs, pumping stations and more than 1000 kms of canals planned for linking the rivers might further hinder the already impaired drainage in most basins thereby exacerbating the flood situation. The simple question that follows relates to 50 years of embankments and large dam centered approach that has perhaps increased India's vulnerability to the floods. Environmentalists have pointed to a paradigm shift in the approach to the floods worldwide—from flood control to flood management and its application in the Indian context. . It has been argued that recovering the experiences of flood

utilisation would be an important component for forging a more viable response to the flood situation in the long run.

21.5.5 Water Pollution

According to Centre for Science and Environment, Delhi, 25 large towns and cities along Ganges discharge close to 1340 million litres per day of sewage mostly untreated waste including traces of heavy metals in the river. Agricultural runoff, mainly fertilizers and pesticides, also find their way through the drains and tributaries. Similarly from the time Yamuna enters Delhi at Wazirabad it is loaded with close to 1700 million litres per day of untreated sewage. In the south, the Noyyal tributary, which flows into the Kaveri River, has over 800 dyeing and bleaching units pouring soda ash, caustic soda, sulphuric acid, hydrochloric acid, sodium peroxide and other chemicals into the river. Even ground water is severely affected by pollution. Over-pumping in some coastal areas has let in sea-water; in others, contaminants such as fluorides and arsenic have been released from rock-strata; and in yet others, agricultural chemicals and industrial wastes have seeped into aquifers. There are some estimates, which indicate that pollution also reduces the volume of available water. According to one such estimate, there is a 6 to 7 per cent decrease in available ground water due to sewage, wastewater and garbage.

21.6 SUMMARY

India is facing an acute water crisis with soaring costs to public health due to pollution and water-borne diseases. The crisis is also due to the lack of access to safe water supply to millions of people as a result of inadequate water management and environmental degradation. The country's huge and growing population is putting a severe strain on all of the country's natural resources. While the total population has risen to one billion people, its supply of water continues to be increasingly contaminated by pesticides, heavy metals and natural pollutants. Every drop of water is locked into the global hydrological cycle. Human actions modify the hydrological cycle and often seriously pollute available freshwater. Climate change is also affecting the hydrological cycle significantly thereby affecting freshwater production and its distribution. Population growth, urbanization and increasing demand from competing uses for drinking, agriculture, industry and energy- the pressures on this finite resource are mounting every day.

India has made progress in the supply of safe water to its people, but gross disparity in coverage exists across the country. Official figures show that around 90 per cent of India's population has access to drinking water. But people who work at improving the water supply say only just over half the country can count on its water being safe and constantly available. The deprivation of these two fundamental human needs impacts every facet of their existence: their health, dignity, environment, livelihoods and indeed the sustainable development of their societies

and consequently their nations. The shortage of water and its growing pollution has acquired the proportion of a crisis especially for the 'poorest of the poor'. And yet there is a false sense of complacency that not only is water an infinite resource but that it also has to be available at no cost resulting in waste, inefficient usage and pollution. Water users barely pay for even the operating costs. There is absolutely no contribution to capital outlays, which are met by domestic governments and external assistance by way of aid or loans. Irrigated farming is generally heavily subsidized placing a severe burden on the budgets of local authorities. Per capita average annual availability of freshwater in the country has reduced from 5,177 cubic metres in 1951 to 1,869 cubic metres in 2001 and would fall further to 1,341 cubic metres in 2025. In a recent study of 27 Asian cities with populations of over 1,000,000, the World Bank says that two Indian cities — New Delhi in the north and Chennai in the south - are the worst performing centers in terms of hours of water availability per day. Mumbai, a western Indian city, is the second worst performer and Calcutta, the fourth. Experts say Delhi could even run out of water within 25 years if strict conservation measures are not brought in soon. Environmental analysts assert that there are at least 100,000 Indian villages facing severe water shortages. If the present consumption patterns continue, two out of every three persons will be living under 'water stressed' conditions by the year 2025. Drastic measures are needed to redeem the situation.

21.7 EXERCISES

- 1) Write an essay on the importance of water as a natural resource.
- 2) Bring out the changes in water management methods from pre-colonial to colonial period.
- 3) Write short notes on the following:
 - i) Inter-State Water Disputes
 - ii) Interlinking of Rivers
 - iii) Big dams versus small dams

21.8 SUGGESTED READING

David Mosse, *The Rule of Water: Statecraft, Ecology and Collective Action in South India*, New Delhi, 2003

Chhatrapati Singh, *Water Law in India*, New Delhi, 1992