CHAPTER ONE

INTRODUCTION

1.1 The River Valley Projects

Since the beginning of the historical era, man has been building dams. The ancient civilizations of Sumeria, Babylonia, Egypt, Combodia, Sri Lanka and India, were all justifiably famed for their irrigation works : indeed, the bunds and tanks which remain at such ancient capitals as Anuradhapura in Sri Lanka, or Angkor Watt in Combodia, still survive to bear proud witness to the engineering skills of those who constructed them 2000 years ago. Today, however, advances in concrete technology and the development of vast earth-moving machines have enabled us to build dams of mammoth size and complexity.

By 1990, the worldwide total of dams over 150 meters in height is expected to have reached 113, of which 49 will have been built during the 1980s. There is a fast development of multipurpose river valley projects in the third world countries, where dams are still considered as the main tool of rapid agricultural development. In the Philippines alone, an estimated 861 dams are in the pipeline. Thirty-nine are already in operation, 12 are under construction and 177 are awaiting construction. A further 31 are being studied, and over 361 have been identified for study. Feasibility studies have been completed on 12 and tentative planning studies are underway on another 229 (Goldsmith & Heldyard, 1984).

Even more impressive than the dams themselves are the vast reservoirs whose waters they serve to impound. In 1970, there were at least 260 man-made reservoirs with a surface area of 100 to 1000 square kilometers, and 40 with a surface area of

more than 1,000 square kilometers. The volume of the water stored in those reservoirs - Some 4,000 cubic kilometers - has been estimated to be "approximately equal to onethird of the water of the earth's atmosphere". The reservoirs behind today's "Super dams" are said to be the only man-made structures which are clearly visible from space.

There is little doubt that at least some of those involved in building the massive "water development" projects sincerely believe that they are improving the lot of mankind. According to them "water resource projects have many positive environment effects, when water management practices regulate and augment low flows of rivers and streams, decrease erosion, prevent floods, eliminate waste of water and in many instances change deserts into gardens where man can comfortably live and prosper, the result is betterment of environmental conditions. The US Corps of Engineers assured the American public in a 1977 publication that, by building dams, it aimed "to preserve the unique and important ecological, aesthetic and cultural values of our national heritage; to conserve and use wisely the natural resources of our nation for the benefit of present and future generations; to restore, maintain and enhance the natural and man-made environment in terms of productivity, variety, spaciousness, beauty and other measures of quality.... and to create new opportunities for the american people to enjoy the environment and the use of natural resources (Goldsmith and Hildyard, 1984).

Indeed, reading the "Official" literature on large-scale dams and other water development projects- that is to say the literature put out by the dam-building industry - one might be forgiven for thinking that such projects can bring nothing but good for mankind. Little mention is made of their social, let alone their ecological, impact.

Dams and other water projects are seen by some as having a vital role to play in ensuring future economic development. By supplying hydro-electricity, dams supply "the power to progress"; and, by providing water for irrigation, they will help boost food production- and thus, it is argued, enable more people to be fed. Recently the less developed countries have started exploiting their hydro-power potential in earnest. Their new-found enthusiasm for this power is understandable as this cheap power is considered as a "Sine qua non" of development, the third world governments have embarked on massive hydro-electricity schemes to exploit to the very full the energy of their rivers.

There is another side to the dam-building coin, a side which the industry involved is less than keen to show off to the public. It portrays a picture of massive ecological destruction, of social misery and of increasing ill-health and impoverishment for those very people whom dams are said to benefit most.

There has been a growing awareness about this other side of the dam building the world over in the recent years, Some of the important questions raised by these experts and scientists after conducting post facto studies in number of multi purpose

dam projects are,

How little of the extra food grown through irrigation schemes ever reaches those who need it most; how, in the long run, those irrigation schemes are turning vast areas of fertile land into self-encrusted deserts; and how, too, the industry powered by dams is further undermining food supplies through pollution and the destruction of agricultural land,

How millions of people have been uprooted from their homes to make way for the reservoir of large dams; how their social lives have been shattered and their cultures destroyed,

How dams are now suspected of triggering earthquakes; how they have failed to control floods and have actually served to increase the severity of flood damage; and how, in many instances, they have reduced the quality of drinking water for millions.

And, finally, how the real beneficiaries of large scale dams and water development schemes have invariably been large multinational companies, the urban elites and the politicians who commissioned the projects in the first place.

One of the inevitable consequences of flooding an area is that those who previously lived there have to be resettled. In some cases, such resettlement has involved the movement of vast number of people. Ghana's Volta Dam, for example, saw the evacuation of some 78,000 people from over 700 towns and villages; Lake Kainji in Nigeria displaced 42,000; the Aswan High Dam, 120,000; the Kariba Dam, 50,000; Turkey's Keban Dam, 30,000 while the Pa Mong project in Vietnam uprooted 450,000

people.

Narmada Valley project in India involves the building of 30 major dams which will itself drown some 150,000 acres of forest, including 35,000 acres of excellent teak forest. For the promotors of large-scale dams, the loss of forests is generally seen only in economic terms, that is in terms of the actual market value of the timber submerged. Thus officials totally ignore the "intangible ecological value" of such benefits as soil preservation, water replenishment, climatic stabilization, air purification or wildlife shelter".

If the intangible benefits provided by trees were taken into account then in the estimation of India's prestigious Forest Research Institute, every tree should be ascribed as economic value of 100,000 rupees per 50 years of its life. But even if the intangible ecological benefits are quantifiable, the social value of forests is not. Moreover, there is no way of calculating the loss of the economic and genetic potential of a forest, for there may be hundreds of species which have not been even identified.

The inevitable loss of wildlife diversity due to the flooding of forests, agricultural land and bush is rarely seen as a reason for presenting the building of a dam. Indeed, at times, the indifference shown by officials to the fate of those natural species which will be drowned by a dam's reservoir is galling.

At a time when experts warn that 20 per cent of the

world's animal and plant diversity could be extinct by the end of the century as a result of poaching and illegal trading alone, the indifference of the Third World and industrialised governments alike to the fate of their wildlife is alarming.

The building of a large-scale dam causes irrevocable environmental destruction. Sadly that destruction does not end with the filling of the reservoir and the inevitable loss of land, forests and wildlife, there is scarcely any aspect of the dams future operations which will not carry a heavy environmental costs.

India is the most important dam building nation in the world, 1500 dams have been built in the country at a cost of Rs.10,556 crores. These multipurpose reservoirs were built to meet the irrigation requirements of the country, reduce the possibility of floods and produce electricity. Far from selving the problems for which they were built, the dams have created fresh problems which were not visiralised at the time they were built.

In case of the resettlement of displaced persons, the planners grant compensation in the form of land elsewhere, they fail to realise the emotional and cultural attachment that people have to their ancestral homes. Also the displaced population generally does not benefit from the fruits of development. And in the bargain, their culture and homes are destroyed. They end up in an alien land and face unemployment and malnutrition. Most often, the compensation is inadequate since the government values

the cost of the property submerged by its own yardstick (Sharma, 1982).

Have floods stopped due to the construction of dams? The answer is that the damage caused by floods is on the increase. Since 1953, we have lost property and crops worth Rs.100 billion. This is due to poor watershed management, large-scale tree felling and the change in the land use patterns. The siltation rate in the reservoirs is five times that of expected, resulting in a sharp drop in their life, a reduction in their water holding capacity mean reductions in the generation of electricity.

The past experience tells us that the resettlement schemes will bring nothing but untold human misery. Indeed, there is scarcely a scheme in existence which has avoided the twin problems of cultural disruption and social alienation.

As a dam is closed, so the waters of its reservoir begin to rise, submerging vast areas of land. Four hundred thousand hectares disappeared beneath the waters of Lake Nasser, while 848,200 ha were lost to the Volta River project; 510,000 ha were flooded by the Kariba Dam, 380,000 ha by the Cabora Bassa Dam in Mozambique and 328,000 by the Guri Project in Venezuela (Goodland, 1977).

In many cases, the flooded area contains thousands of acres of good agricultural land. In India, for example, the Srisailam hydel project in Karnataka flooded some 107,000 acres of farmland - land which, until the dam was closed, had provided a livelihood for some 100,000 people.

Quite apart from causing the loss of agricultural land, dams have also caused the drowning of thousands of hectares of forest. It is estimated that between 1950 and 1975, India alone lost 479,000 hectares of prime forest land to various river valley projects.

Though all dams do not induce earthquakes, the cases of Koyna and Bhatsa dams in Maharashtra, India are significant. Koyna ranks first as far as the intensity of earthquakes is concerned. On ~~September~~ December 11, 1967, the first shock killed 177 people; but the subsequent shocks did not do much damage because by that time people had migrated in large numbers. The quake forced the inhabitants of Bhatsa Dam to leave their villages. Though initially there was difference of opinions about the relation between dams and earthquakes now the experts world over agree about the Reservoir Induced Seismicity (RIS).

The execution of irrigation and hydroelectric projects involves the coming of several thousand labourers at the projects sites. These labourers require timber for their huts, and fuel for their day-to-day living, and so far they have always depended on the forest to meet these requirements. Vast tracts of these virgin forests have thus disappeared due to the activity of the labourers who had no resource but to cut them down in order to survive.

This could have been alleviated, if not altogether avoided, had the labourers been provided with some tin or asbestos sheds and a regular fuel supply. This fuel supply could atleast in part have been based on the wood cleared from

the submersion area.

The maintenance of a proper cover of vegetation in the catchment area of any reservoir is vital to its proper functioning. Such vegetation regulates the flow of water into the reservoir, preventing floods and maintaining water flow in the dry season, and more crucially prevents excessive erosion of soil.

Soil erosion in the catchment area and the consequent siltation of reservoirs has been a major problem in India, is well known. Thus, for the 18 reservoirs all over India for which data is available, the observed siltation rate has exceeded the expected siltation rate in all but one of the cases. Moreover, the observed rate is generally 3 to 10 times as high as the expected siltation rate. The consequent drastic reduction in the useful life of the reservoirs has obviously serious economic implications (Gadgil, 1981).

Hydroelectric and irrigation projects often open up previously inaccessible regions rich in timber and wild-life to new agricultural settlers and poachers of both timber and wildlife. It is feared that the new settlements in the study area will lead to irreversible damage. These settlers are likely to follow the pattern of settlers in the Idikki and silent valley area where they have already colonised steep slopes unfit for cultivation on a substained basis without very heavy investment in soil conservation measures.

Wealthier and better organised poachers, wood contractors, and neo-rich farmers of the area take advantage of the improved

Table No.1 : Comparison of the number of species in five animal classes found in the World, India, Maharashtra and Western Ghats (Samant et al. 1988)

	World	India		Maharashtra		Western Ghat	
		No.	%	No.	%	No.	%
Mammals	4,500	320	7.2	85	26.56	79	92.94
Birds	8,600	1260	14.65	500	39.68	412	82.4
Reptiles	5,000	440	8.8	100	22.72	71	71
Fishes	23,000	1400	6.08	600	42.85	166	27.67
Amphibians	-	130	-	22	16.92	20	90.90

access facilities for smuggling out more valuable timber and poaching wild animals. These activities are naturally much more difficult to document. Also will for concerned Govt. Officials and political pressure and interference agravate the situation.

In 1977 the once famous Dandeli Wildlife Sanctuary was on the verge of being declared as a sanctuary because of the severe depletion of wildlife consequent on the opening up of the area with the Kali hydroelectric projects.

The tremendous genetic diversity of living organisms created by hundreds of million years of evolution is a precious heritage of man. These have yielded to us a variety of food, fibres and vital drugs and their maintenance is crucial to further progress in these fields. This is why the Food and Agricultural Organisation (FAO) of the United Nations has launched a vigorous programme of the maintenance of genetic diversity of wild relatives of cultivated plants. The Western Ghats harbour a large variety of these, ranging from ragi, paddy, mango, jackfruit and many more.

The large impact of the irrigation and hydroelectric projects on the Western Ghats has sharply reduced the biological diversity of this region. These projects have selectively affected high rainfall areas, and areas near water-courses which tend to harbour evergreen tree species. They have thus contributed to the sharp reduction in the extent of evergreen forests on the Western Ghats. These forests have been a unique

storehouse of many plant and animal species occuring nowhere else in the world and it is only our profound ignorance which has marked the many extinctions of biological species. According to Father Saldhana, a ground plant taxonomist, Hubbardia heptaneuron Bor., a grass that was once known to grow in the spray zone of the famous Jog Falls of Sharavati and nowhere else in the world has apparantly gone extinct with the execution of the Sharavati power project (Gadgil, 1981). It can be seen from Table No.1 that however, the Western Ghats still have excellent diversity of the five vertebrac class, though in fragmented forests.

The current development efforts are diverted towards immediate but short term gains and obviously fail in many ways when viewed from different perspectives. The logical question one may ask is why it is then that these failures have attracted so little attention in the country? This is because the urbanised planners, decision-makers and politicians are several stages removed from direct dependence on the natural resources, and are therefore immune from the immediate negative consequences of the unbalanced developmental process. It is the local peasants and tribals depending much more directly on the natural resources that bear the brunt of the immediate negative consequences of the dam projects.

Now there is heated debate the world over and particularly in the fast developing countries, from the third world like India, about constructing large dams. After the

evaluation of number of dam projects many experts have come to conclusion that dam construction is a waste both from the social and environmental point of view. Though the recent laws demand a full environmental impact assessment report, only the planners can reveal how many reports on the subjects have been acted upon. Most often such reports are shelved, only political decisions play a role (Paranjpye, 1988).

1.2 The Western Ghats

The hill chain of the Western Ghats runs parallel to the west coast of India from the river Tapi in the north to the Kanyakumari in the South. The Ghats descend steeply to coastal plains on the west, but merge rather gently through a series of hills with the Deccan plateau. Geologically the Ghats fall into two sections; north of the river Kali is the Deccan trap country of relatively fragile rocks and flat hill tops. The hills do not rise much beyond 1500 meters in this track.

The Western Ghats force the moisture leaden winds coming off the Arabian sea and receive consequently heavy precipitation of 2000 mm or more a year. The eastern slopes of the Ghats are much drier than the western faces. The raining is heavier to the south and extends over 8-9 months a year. It is much lower and restricted to 4 months only of the south west monsoon in the northern parts of the Western Ghats i.e. in Maharashtra, therefore the use of the short rainy season becomes very important. Given this rainfall regime the western slopes of the Ghats have

a natural cover of evergreen forest, which changes to moist and than dry deciduous types as one comes to the eastern slopes.

The Western Ghats are a treasure house of plant and animal life, next only to the Himalayan tracts in the variety of unique plant and animal species. The Ghats also harbour a number of wild relatives of cultivated plants. This diversity has been on continual decline over the last century and more specially in the recent decades, with many biological community types almost totally eliminated. Recent decades have, however, seen serious measures being initiated to conserve some of this fast vanishing biological diversity with the constitution of wildlife sanctuaries.

The traditional land use on the Ghats has been paddy cultivation in the valley, supplemented by cultivation of millets and legumes on the hill slope. The hill slope agriculture used to be largely of the shifting slash and burn type, but this has gradually been changed to cultivation of terraces. Cattle and buffalo were maintained in great numbers wherever the natural vegetation was deciduous forest, but these were largely absent in tracts of evergreen vegetation. These lands have been considerably over exploited and degraded in recent decades.

The demands on reserved forests have been mounting of recent years with an explosion of forest based industries. There have been other competing demands on reserved forest lands as well, especially for cultivation and river valley

projects. Several industries have been started in recent decades primarily to utilise the forest resource of the Western Ghats since the first world war. These have included Saw Mills, brick and tile, paper, tanning etc. A few other industries like Sugar, distilleries, polyfiber etc. have sprung up recently with total base on the forest and mineral resources of the Western Ghats.

Transport and communication has been difficult on the Western Ghats because of the hilly terrain, heavy rain and thick forests. A spirit was given to the development of these facilities after independence when major river valley and mining projects brought in extensive transport and communication facilities in their wake.

The Western Ghats have always been sparsely populated as compared to the adjoining plains, because of the difficult terrain. The settlements on the Ghats have been of small sizes and scattered, the bigger towns all falling on the eastern side on banks of major rivers or on the west coast at mouths of rivers where they served as ports.

The Western Ghats people have traditionally depended on the natural vegetations for meeting their requirements of shelter, fodder and fuel. They also derived much nutrition from hunted meat. Consequently, their quality of life has rapidly gone down in recent decades due to depletion of natural vegetation and extermination of wild animals. The major gain for the people is being modern health and educational facilities

which have percolated only a little to the hills, by growing transportation and communication. Today we clearly see that the tribals and peasents have borne the brunt of the degradation of the Ghat's, environment and have received scarcely any benefits of development (Gadgil, 1988).

Success in evolution of a species is measured in terms of survival, failure by extinction. Most recent extinctions, however, can be imported either directly or indirectly to man, more specially to man's demographic and technological expansion. For many of the plant species also, extinction has been caused by man particularly due to the habitat destruction. In India an inventory of 135 threatend species of plants has been prepared, which includes many plants from the Western Ghats by International Union of Conservation of Nature and Natural Resources (IUCN, 1980).

Majority of recent extinctions, both in plants and animals are, however, attributed to environmental change arising from alteration, degradation or destruction of natural habitats, deforestation, agricultural practices and expansion, river valley projects and submergence, unrestricted grazing, hunting and various developmental activities in the catchments.

In India, particularly after independence there was mass scale reduction in the natural vegetation which was fragmented to such an extent that it resulted in rappid dwindling of wild animals in the region. The process of degradation of natural habitats was accelarated by new governmental policies like grow

more food campaign, green revolution, operation milk flood, multipurpose river valley projects etc.

Koyna Wildlife Sanctuary (423.5 sq.km.) is one such area which was declared in September 1985 by the Government of Maharashtra. Also areas in the country having specific biological diversity and have been identified as areas of importance for Biosphere Reserves, (Gadgil and Meher Homji, 1986).

Considering the crucial role played by the threatened forests of the Western Ghats in conserving the excellent biological diversity and maintaining the ecological balance of the Indian penninsula some of such fragmented patches of forests have been declared in the recent years, by the State and Central Government, as Wildlife Sanctuaries and National Parks. There is an additional dimension to this development as most of these forests from the high rainfall region of the Western Ghats Constitute the catchments of number of large multipurpose dam projects. Therefore it is expected that the new strict forest acts will be useful to conserve the degrading catchments of dam projects in the region.

1.3 Koyna Dam Project

The Koyna Dam Project took shape mainly as a result of the increasing requirements of power of the highly industrialised city of Bombay and its environs. This region, short of power for several years, was experiencing an acute shortage with its phenomenal growth after the Second World War.

Moreover, certain areas in the Southern part of the state have been periodical victims of water scarcity or famine owing to the frequent failure of the monsoon. These areas needed an assured supply of water for irrigation and cheap power for lift irrigation. At the same time the processes of industrialisation in rural Maharashtra badly needed cheap power.

Actually the reported House of Tatas who had earlier commissioned the first Hydro-Electric Power Station in the then Bombay State - at Khopoli in 1915 had started initial surveys on this project around 1910. After the first world war of 1914 to 1918 the surveys were again taken up in 1930-31. But then again due to the Second World War from 1939 to 1944 the surveys got hindered. When the work of development of the Power project was taken over by the then Electric Grid Department of Bombay State in 1945, the Govt. Engineers made detail investigation and studied the underground powerhouse proposals in consultation with a Swiss consulting engineering firm and others and the Koyna Hydro-Electric Project Stage-I was approved by Government in 1953. This Scheme also provided for irrigation storage for serving irrigation on the dams of Koyna and Krishna

rivers upto the State boundry.

In the ultimate stage of development of Koyna Hydro-Electric Project, the Koyna Complex will be a peaking station generating 1420 MW power. Due to the impoundment of water behind Koyna dam, 11536 hectares of land has been submerged. In all 9069 families from 98 villages have been rehabilated at 138 places in Satara, Sangli, Thane, ~~Kulaba~~ Raigarh and Ratnagiri districts.

1.4 Scope of Work

In the recent years some workers have concentrated their efforts on investigating socio-economic aspects of dam projects in the country. However almost no attention has been paid to evaluate the impact of dams on the biological diversity in the catchment areas of these projects. In case of Koyna Hydro-Electric Project, the current study is the pioneering effort to study the impact of dam construction and subsequent agricultural practices on the animal diversity of the catchment area.

Due to the limited resources and time at disposal, the scope of the work was restricted to mammalian diversity only. However, the lists of commonly found plants and birds, reptiles and fishes observed during the investigations have been included. For the study partial catchment of Koyna dam from the Patan Tahasil was selected because of the contrast of vegetation cover and land use practices on the eastern and western catchments. Similarly some area outside the catchment was also studied for

comparision purpose. In September 1985 the study area was declared by the State Government as a Koyna Wildlife Sanctuary (423.5 sq.kms.).

During the investigations all the settlements (n = 21) from the study area were surveyed for various human activities like agriculture practices, animal husbandry, deforestation, hunting and poaching, fishing, etc.

Human activities in the study area were found playing a crucial role on the survival of the animal diversity of the region. The study was carried out from June 1986 till August 1987, in which a detail survey was conducted in 479 households in all the 20 villages in the study area from the Koyna Wildlife Sanctuary. The data generated during the investigations was computer analysed for precise results.