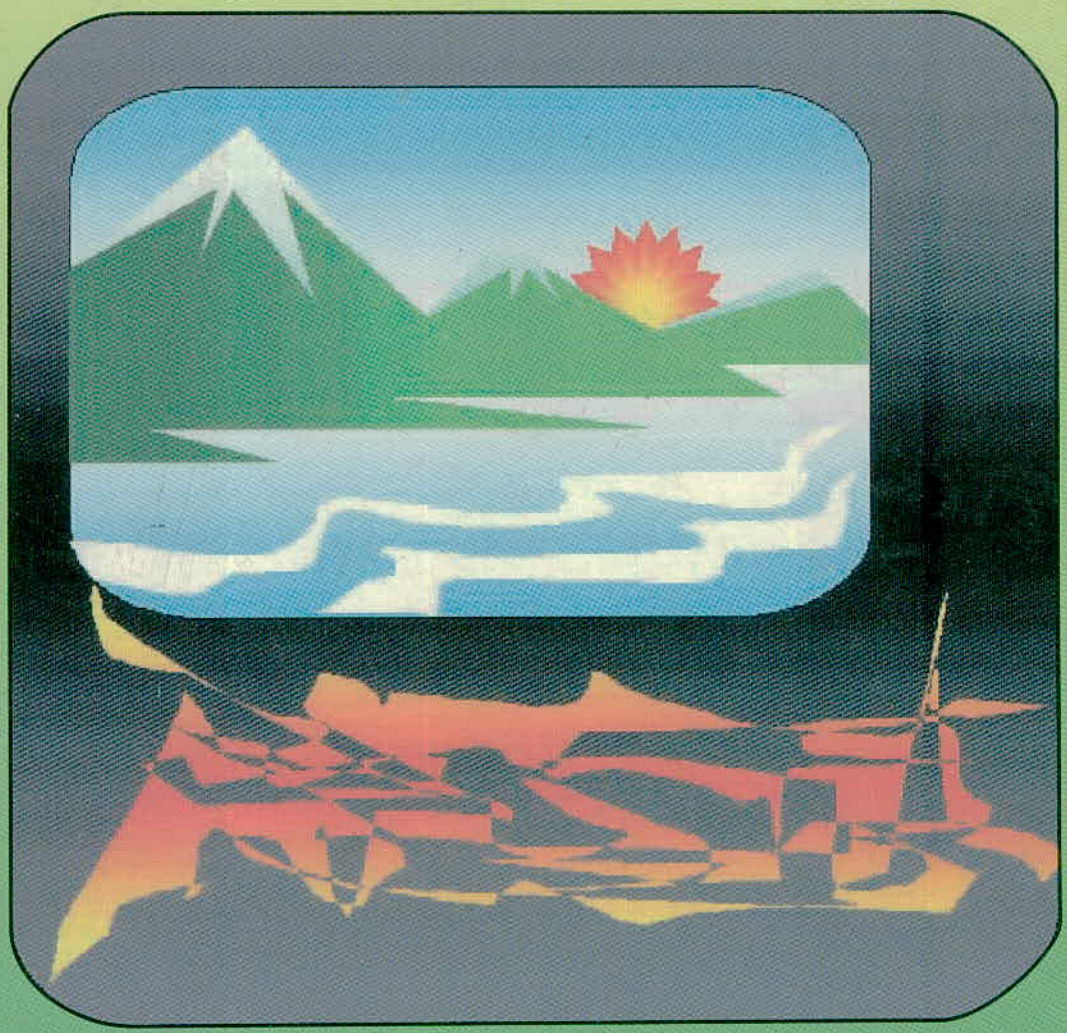
COMPENDIUM OF ENVIRONMENT STATISTICS 1998



सत्यमेव जयते

CENTRAL STATISTICAL ORGANISATION
DEPARTMENT OF STATISTICS
MINISTRY OF PLANNING AND PROGRAMME IMPLEMENTATION
GOVERNMENT OF INDIA
NEW DELHI

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PREFACE

The accelerated growth of industrialisation has caused excessive pressure on our environment and is causing wide-scale disturbances in nature's equilibrium. In fact, the ill–effects of man's rapid march towards development are already being felt. It is now acknowledged universally that neglect and disregard for the environment will boomerang on us. This has led to the realisation that the only way for the mankind to survive is by adopting the path of sustainable development, i.e. development in which nurturing the surroundings of man is an integral part so that the delicate equilibrium among the different components of nature is preserved.

To have a good understanding of our environment, and to be able to understand the problems and take appropriate preventive and corrective steps, it is imperative to build up a good database on various aspects of the environment. The Central Statistical Organisation (CSO), being the nodal agency for development of the Statistical system in India, has been seized with this issue since the early eighties. The CSO interacted with academicians, researchers, various government and private organisations as well as international agencies, and in 1997 came out with the publication "Compendium of Environment Statistics, 1997". This publication presented, for the first time, the data on various aspects of environment statistics at one place.

The present publication is an improvement over the previous one in that a new section on mining statistics, apart from some new tables in other sections, has been added. Many other tables, in respect of which recent and more accurate information was available, have been updated.

CSO is thankful to all the agencies which have provided the data for the present edition. We look forward to their continued support.

This compendium has been prepared by the team headed by Shri Harish Chandra, Joint Director and comprising Dr. (Smt.) Sunita Chitkara and Shri Ajay Kumar Gupta, both Deputy Directors, Shri H.N.Rai, Assistant Director, Shri Lokesh Kumar and Shri Vijay Kumar, both Sr. Computers, under the overall supervision of Shri R.L.Narasimhan, Deputy Director General.

It has been always been the endeavour of CSO to improve the quality of its publications. Therefore, any suggestions/comments regarding the content as well as the presentation of data in this publication would be welcome.

(M. D. ASTHANA)
Secretary
Department of Statistics

New Delhi
February, 1999

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OVERVIEW

The Compendium has been prepared under the broad Framework for Development of Environment Statistics provided by the United Nations Statistics Division and adopted by the Steering Committee on the Environment Statistics for the 1997 issue. The same pattern have been followed in the present issue. The six parameters of the framework namely flora, fauna, atmosphere, water, land/soil, and human settlements have been used to divide the compendium in different chapters. The chapters are further divided into sections, based on different factors related to that parameter. An attempt has been made, wherever possible to elaborate the data in the tables with the help of boxes under the table and suitable graphs and charts for easy comprehension.

The broad features of the compendium are summarised below:

The compendium is divided into seven chapters.

The first chapter on Environment and Environment degradation gives a general introduction of the concept of environment; development versus environment degradation; impacts of development activities on environment; Emissions, discharges and their sources; Some major pollutants and their sources and pollutants and their related health hazards.

The second chapter on development of Environment statistics in India summarised the activities undertaken by the Department of Statistics for the development of environment statistics.

The third chapter on Biodiversity is divided into three sections : Flora; Forests and Fauna. The section on Flora contains some statistics on plant species found in India, species which are rare, vulnerable, endangered and extinct. It also gives some statistics on preservation measure of flora like Biosphere reserves, Botanical gardens and gene banks in India. The section on Forests contains statistics on Indian forests. It gives information on percentage of forest area to total geographic area (state-wise), wastelands and external aids received for social forestry .

The section on Fauna gives the major bio-geographic habitats in India, estimated number of species, national parks and wildlife sanctuaries, tiger reserves, livestock population in India, Fish production and Bovine population affected by drought.

The chapter on Atmosphere is divided into six sections: Air; Energy; Greenhouse Gases; Transport; Industry; and Noise . The section on Air gives the composition of the troposphere; Ambient Air Quality Standards and state of ambient air quality in ten major cities. The section on energy gives information on installed capacity of utilities; electricity generation; different fuels used for

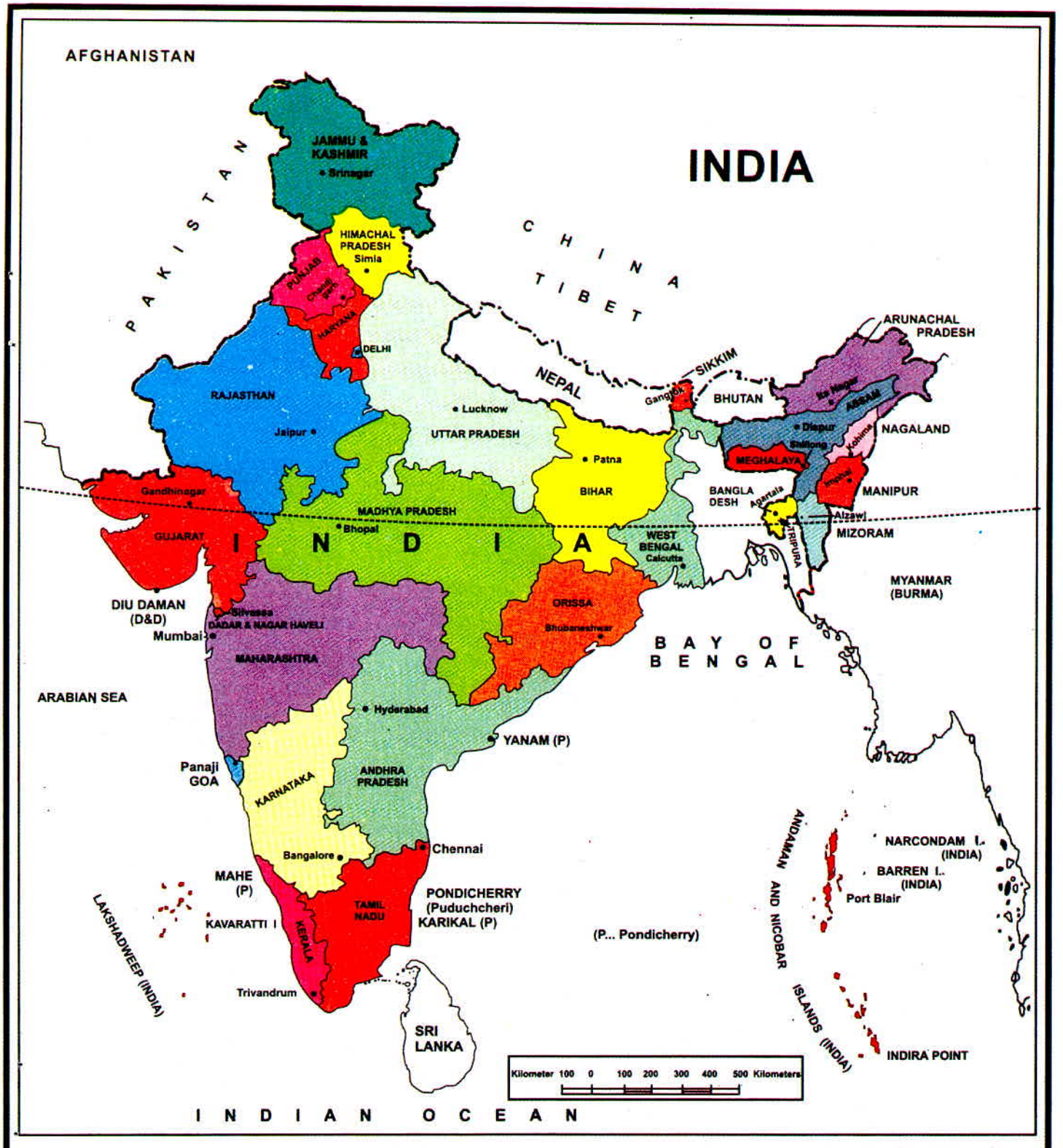
cooking; coal resources in India; and renewable energy resources. The section on Greenhouse gases gives information on the key greenhouse gases and the effect of global warming. The section on Transport gives information on the increasing number of vehicles in India and urban air pollution caused by vehicular emissions. The section on Industries gives information on the number of registered industries in India and the status of pollution control in 17 categories of industries. The section on Noise gives information on the ambient noise standards ; average noise levels in various metropolitan cities and effects of noise pollution on human health

The chapter on Land / Soil is divided into four sections: Land uses, Agriculture, Natural disasters and mining. The section on land uses contains land use classification in India, and different land use patterns. The section on agriculture contains information on area under principal crops; performance of crop production; use of agricultural inputs; consumption of pesticides and their effect on soil. The section on natural disasters contains information on frequently occurring natural disasters; recent natural disasters in India; major earthquakes; number of drought-prone districts and damages due to droughts. The section on mining gives data on number of mines, production of minerals, status of afforestation, mining machinery and consumption of explosives in mining.

The chapter on Water is divided into two section : Ground water and marine water. The section on ground water contains information on rainfall performance during the last 20 years ; water flow in streams and ground water resources ; water quality criteria and distribution of water monitoring stations. The section on marine water contains information on coastline of India ; main activities along the coastal zones ; industrial and sewage discharges to coastal waters ; pollutants and their impacts on marine environment and potential hot spots along the Indian coasts.

Chapter seven is on human and poverty settlements. This chapter has been divided into four parts namely Population and Poverty; Housing, Slums and Basic Facilities; Urbanisation; and Waste Management. Human development is adversely affected by the environmental degradation. Safe drinking water and sanitation are closely linked with two of the very important human development indicators viz. infant mortality and life expectancy. Further, rapid urbanization has added to the problem. This has given rise to increase in urban population residing in slum where there is no access to sanitation and safe drinking water.

Due to rapid growth in urbanization, there is substantial increase in generation of solid waste. When this solid waste is not collected and disposed off effectively and efficiently, it attracts rodents and flies which then spread diseases. It also pollutes and degrades land and water resources. If these wastes are left untreated they would ferment slowly and would produce bio-gas which would be distributed in the atmosphere.



1. Based upon Survey of India Map printed in 1994.
2. The territorial waters of India extended into the sea to a distance of twelve nautical miles measured from the appropriate base line.
3. The interstate boundaries between Arunachal Pradesh, Assam and Meghalaya shown on this map is as interpreted from the North-Eastern Areas (reorganisation) act. 1971, but have yet to be verified.
4. The administrative headquarters of Chandigarh, Haryana and Punjab are Chandigarh.
5. Responsibility for the correctness of the internal details shown on the map rests with the publisher.

CHAPTER ONE

ENVIRONMENT

AND

ENVIRONMENT DEGRADATION

Environment can be defined as the totality of man's surrounding. It may be referred as "the sum of all social, biological and physical or chemical factors which constitute the surroundings of man". Each element of these surroundings constitutes a resource which man utilises in different ways to develop and lead a better life. In the beginning, man was shaped by the environment which controlled and shaped its evolution and man remained in equilibrium with the environment. But in the quest of its development , man broke this equilibrium and since then he is exerting an ever increasing influence on his environment. Due to growing urbanisation and industrialisation , man distorted its environment and the intensity of this distortion was felt only when it exceeded the limits beyond which it became irrepairable.

1.1 DEVELOPMENT VERSUS ENVIRONMENT DEGRADATION

All developmental activities, irrespective of their scale, nature and magnitude affect the environment . The impacts of these developmental activities may have short-term as well as long-term implications. The short-term implications may be negligible as compared to the benefits of the developmental programmes, but the long-term implications may further create new ecological and environment problems, the solutions for which may not be easy to find. Some of these implications may be summarised in terms of vast areas of deforested lands, denudation of slopes, soil erosion and silting of rivers, regular occurrence of floods and droughts, impoverishment of important fauna and flora, changed climate, polluted water unfit to drink and contaminated air unfit to breathe.

TABLE 1.1.1 : SOME IMPACTS OF DEVELOPMENT ACTIVITIES ON ENVIRONMENT

Development activities	Major impacts on environment
Forest clearing and land settlements	Extinction of rare species of flora and fauna, creation of conditions for mosquito breeding leading to infectious diseases.
Shifting cultivation in upland agriculture	Soil erosion in upland areas, soil fertility declines due to shorter cultivation cycle, flooding of low land areas.
Agro industries	Air pollution due to burning of bagasse as fuel in sugar mills, large amount of highly polluting organic wastes, surface water pollution.
Introduction of new varieties of cereals	Reduction of genetic diversity of traditional monoculture resulting in instability, danger of multiplication of local pests or local strains of fungus, bacteria or virus on new variety.
Use of pesticides	Organisms develop resistance and new control methods are needed (e.g. in malaria widespread use of dieldrin as a prophylactic agent against pests of oil palms made the problem worse), creation of complex and widespread environmental problems .
Timber extraction	Degrades land, destroy surface soil, reduces production potential of future forests.
Urbanisation and industrialisation	Concentration of population making huge demands on rural environment, air and water pollution.
Water resources projects, e.g. Dam, extensive irrigation	Human settlement and resettlement, spread of waterborne diseases, reduction of fisheries, siltation, physical changes e.g. temperature, humidity.

1.2 EMISSIONS, DISCHARGES AND THEIR SOURCES

The environmental stress caused by developmental activities derives from emissions and discharges of various substances into air, water and soil. These emissions and discharges have not only local but regional and global effects also :

TABLE 1.2.1 : LOCAL, REGIONAL AND GLOBAL EFFECTS OF POLLUTION

Local effects	Regional	Over marine water and continents	Global
· Heavy metals in air, soil and plants, e.g. from industrial emissions and discharges · Noise · Smell · Air pollution	· Eutrophication · Contaminants in the soil · Landscape changes, due to e.g. mining or agriculture	· Eutrophication · Acidification · Environment contaminants · Radioactivity	· Changes of the climate due to ozone depletion and the green-house effect

Acidifying emissions

Sulphur dioxide and nitrogen oxides emitted into the air are converted into acids. At their deposition they have an acidifying effect on soil and water. The emission of ammonia also contributes to the acidification. Main sources of sulphur dioxide are burning of Sulphur containing fuels like coal in power stations and oil by vehicles,and refining of oils in refineries.

Emissions of volatile organic substances

Volatile organic substances might have health effects. Many of them are carcinogenic. In combination with nitrogen oxides and in sunlight, some of them might form ozone and other photochemical oxidants. These are harmful to plants.

Gases effecting the climate

The greenhouse gases (carbon dioxide, methane etc.) prevent some of the heat radiation from the earth from escaping into space. The concentration of green house gases is increasing, which is presumed to raise the temperature of the earth in a long perspective. Eighty percent of the effect of the greenhouse gases is caused by carbon dioxide.

Eutrophicating discharges into water

Nutrients, mainly nitrogen and phosphorus contribute to the eutrophication of lakes, rivers and marine waters. Approximately half of the nitrogen discharges is estimated to originate from agricultural land. A considerable proportion of the phosphorous discharges derives from waste water not passing through sewage treatment plants. In addition to discharges from human activities there is a natural leaching from various types of soil. The quantities are estimated to be of about the same magnitude as those originating from human activities.

Emissions of heavy metals

Discharges and emissions of heavy metals are difficult to estimate. A large proportion of emissions/ discharges of heavy metals into air originates from the iron and steel industry. Road traffic is the main source of lead emissions. Mines and mining wastes account for the major part of the discharges of heavy metals into water. Cadmium depositions also originate from commercial fertilizers containing phosphorus.

TABLE 1.2.2 : SOME MAJOR POLLUTANTS AND THEIR SOURCES

Pollutant	*Source*
Carbon monoxide	Incomplete fuel combustion (e.g. two-stroke engine)
Sulphur dioxide	Burning of sulphur containing fuels like coal in power stations and oil by vehicles
Suspended particulate matter	Smoke from domestic, industrial and vehicular sources.
Oxides of nitrogen	Fuel combustion in motor vehicles, power stations and furnaces.
Volatile hydrocarbons	Partial combustion of carbonaceous fuels (two-stroke engines, industrial processes, disposal of solid wastes).
Oxidants and ozone	Emissions from motor vehicles, photochemical reactions of nitrogen oxides and reactive hydrocarbons.
Lead	Emissions from motor vehicles

TABLE 1.2.3 : POLLUTANTS AND THEIR RELATED HEALTH HAZARDS

Pollutants	*Effect on human health*
Carbon monoxide	Affects the cardiovascular system
Nitrogen oxides	Affects the respiratory system
Ozone	Causes increased sensitivity to infections, lung diseases, irritation in eyes, nose and throat
Sulphur dioxide	Affects the functions of lungs
Solid Particulate Matter (SPM)	Small particles are poisonous. They are carriers of carcinogenic tracer elements.
Volatile organic substances (VOC)	e.g. benzene are carcinogenic

CHAPTER TWO

DEVELOPMENT OF ENVIRONMENT STATISTICS IN INDIA

After the United Nations Conference on Human Environment held at Stockholm in 1972, India too, set up a separate Ministry of Environment and Forests, which is engaged in the task of managing country's environment by focussing on the development of important administrative tools and techniques, impact assessment, research and collection and dissemination of environmental information. However, environment being a cross-sectional and multidisciplinary concept, it is not easy to collect, analyse and study relationships between various data on a wide-variety of subjects like flora, fauna, atmosphere, water, land/soil and human settlements. It is, therefore, necessary to develop an efficient environmental statistical system in the country which can meet the growing demands of various governmental agencies and environmentalists and general public for data on various aspects of environment.

2.1 EMERGENCE OF ENVIRONMENT STATISTICS IN INDIA

Recognising the importance of Environment Statistics as an emerging area, the subject was first discussed in the Fifth Conference of Central and State Statistical Organisations (CSSO) held at New Delhi in 1981. The conference recommended the need for developing an appropriate environment statistics system in the country. The subject was again discussed in the Sixth and Seventh Conferences of CSSO. On the recommendation of Seventh Conference of CSSO held in 1985, a multi-disciplinary working group comprising Department of Environment, Central Statistical Organization (CSO) , State Directorates of Economics and Statistics, and other concerned Central and State Organisations and research institutions involved in the related subjects was set up in July 1986 by the Central Statistical Organisation under the chairmanship of the then DG, CSO. The working group reviewed the availability of data , identified various parameters and assigned priorities to major areas of concern.

The working group submitted its report in November,1990 which provided a provisional framework for the development of environment statistics in India under the six internationally recognised parameters of Flora, Fauna, Atmosphere, Water, Land/soil and Human Settlements based on the United Nations Framework for Development of Environment Statistics

TABLE 2.1.1 : FRAMEWORK FOR DEVELOPMENT OF ENVIRONMENT STATISTICS

Components of environment	Social and economic activities, natural events	Environmental impacts of activities/ events	Responses to environmental impacts	Stocks and inventories
Flora				
Fauna				
Atmosphere				
Water a) Fresh water b) Marine water				
Land / Soil a) Surface b) Sub-Surface				
Human Settlements				

To provide table formats for compilation and dissemination of data under these parameters, four subgroups were constituted by CSO in 1991. In the year 1996 , a separate cell on environment statistics was created in CSO.

2.2 FORMATION OF STEERING COMMITTEE ON ENVIRONMENT STATISTICS

During the second half of 1996, a Steering Committee on Environment Statistics was constituted under the chairmanship of Dr. S. S. Srivastava, Director General, CSO. The composition and terms of reference of the Steering Committee are given in the Appendix 9.

The first meeting of the Steering Committee was held on 21 January1997 at Central Statistical Organization, Delhi. In this meeting the draft framework for the development of environment statistics, table formats to be used for preparing the compendium and future activities of the Asian Development Bank Project on Institutional Strengthening and Development of Environment Statistics were discussed . The data source agencies were identified and it was also decided to hold a workshop cum second meeting of the steering committee to discuss various issues related to the environment statistics alongwith the draft of proposed compendium of environment statistics. In the workshop cum second meeting of the committee held at Yashwantrao Chavan Academy of Development Administration , Pune during 20 to 21 March,1997 , besides discussing the draft compendium, nine papers were presented on different topics related to environment statistics.

On the basis of discussions held in the second meeting, CSO prepared a draft of the Compendium of Environment Statistics. In the third meeting of the Steering Committee, held on 9 August, 1997 the compendium on Environment Statistics was finalised . With some modifications as suggested by the members of the Steering Committee, the Compendium On Environment Statistics 1997 issue was released.

The Steering Committee Meetings were attended by Smt. Usha Ghosh, System Analyst of CPCB and Shri D. Bandhopadhaya, Additional Director, Ministry of Environment & Forests on behalf of their Organisations. Shri R.N. Khosla, Group Leader & Environment Specialist represented Tata Consultancy Services in place Smt. Usha Munshi, who left the Organization.

2.3 NATIONAL WORKSHOP ON ENVIRONMENT STATISTICS

To disseminate the information on Development of Environment Statistics in India and to provide a forum for interaction between users and producers, a national workshop was organised in Goa(India) during January 12-13 , 1998 .The workshop was attended by academicians, data users and data producing agencies. The workshop had seven technical sessions in which more than twenty papers were presented. The sessions focussed on different aspects of environment like environment statistics, environment, population and human health, status of data bases on different types of pollution; status of data bases on human settlements and its impact on other aspects of environment; status of data bases on land and soil and their degradation; and natural resource accounting. The proceedings of the workshop has been released in book form can be obtained from the Director General, Central Statistical Organisation.

2.4 INTERNATIONAL TRAINING ON ENVIRONMENT STATISTICS

A two week training course on Environment Statistics was conducted by Central Statistiacal Organisation at New Delhi from 27th January to 6th February, 1998 with funding support from Asian Development Bank (ADB) and the organisational support from Tata Energy Research Institute (TERI). The course curriculum had been finalised in consultation with various experts working in the area. In all 22 participants from Bangladesh, Indonesia, Malaysia, Nepal, Philippines, Sri Lanka and Vietnam ,including 9 from India, attended the course.

The training consisted of lectures delivered by national and international faculty, besides visits to libraries/organizations involved in collection and compilation of relevant databases. The lectures covered the following topics:

Basic statistics on mineral and forest wealth, flora, fauna etc;
Water, soil and land use;
Air and water pollution, solid waste and hazardous wastes;
Energy;
Environmental indicators;
Classification and standardization.

The training programme enabled the participants to understand the concepts, definitions and classifications of statistical variables that describe high priority environmental issues in almost all countries, and which can be compiled by national statistical services of different countries under an environment statistics programme. The statistical variables identified in this manner reflect the typical data needs of planners, policy makers and administrators working in environment and related socio-economic fields.

2.5 NATURAL RESOURCE ACCOUNTING IN GOA

Department of Statistics has initiated a pilot project on Natural Resource Accounting in Goa to link the estimation of State Domestic Product with Natural Resources. After the development of a suitable methodology, this may be extended to other states as well so as to arrive at an overall estimate for the country as a whole. A technical working group on Natural Resource Accounting has been constituted under the chairmanship of Secretary , Department of Statistics and the first meeting of this group took place on 19th November 1997. Following the deliberations a concept paper indicating the methodology to be adopted, availability of present data and the requirement of additional data to be collected etc. was prepared by TERI and considered by the Technical Working Group in its meeting held on 23rd September 1998. On the recommendation of the Working Group, TERI has been entrusted the work of first phase of the project involving identification and collection of secondary data covering all sectors, but with main emphasis on the following sectors:

i) Forest and Bio-diversity
ii) Marine Resources
iii) Minerals
iv) Tourism
v) Energy

CHAPTER THREE

BIODIVERSITY

India has a rich heritage of species and genetic strains of flora and fauna. Overall six percent of world species are found in India. It is estimated that India is tenth among the plant rich countries of the world, eleventh in terms of number of endemic species of higher vertebrates and sixth among the centers of diversity and origin of agrodiversity. The total number of living species identified in India so far is 150,000. Out of the total twelve biodiversity hot-spots in the world, India has two, one is the northeast region and other is the western ghats.

However, the ecological balance of flora, fauna and forests is being drastically disturbed by the rapid increase in human population. The growing urbanisation and industrialisation costs the decrease of natural habitats, which further results in the loss to biological diversity. Biodiversity, once lost can not be recovered.

Under the pressures of an exploding population, and unplanned development, the natural habitats of our species are being rapidly lost or modified. It is estimated that in the worldwide perspective slightly over 1000 animal species and sub-species are threatened with an extinction rate of one per year, while 20,000 flowering plants are thought to be at risk.

It is interesting to note that about six percent of the world's plant and animal species are found in India. However, of these several species have been classified as rare, endangered or threatened with extinction.

The three factors responsible for extinction of wildlife are:

i) Reduction of its habitat area.
ii) Disappearance of its prey
iii) The relentless persuasion of certain animals by man

3.1 CONSERVATION MEASURES

Project Tiger

Project tiger was initiated in 1973, in response to the alarming decrease in the population of wild tigers. In 1973, nine tiger reserves in nine states were set up. Today there are 23 reserves spread over 20 states.

The main objective of project tiger is to preserve tiger in specially constituted reserves, representing different habitat types with the aim of maintenance of available tiger population in India in its natural environment. One of the main achievements of project tiger is the excellent recovery of habitat and increase in population of all wildlife in the reserves.

National Parks and Wildlife Sanctuaries

The wildlife (Protection) Act provided for setting up national parks and sanctuaries for wildlife. The basic idea in trying to encourage wildlife is that human welfare is intimately linked with it. The Government of India has pledged for all-out efforts to conserve, which not only seeks to protect and preserve what remains of wild fauna and flora but also seeks to augment this priceless national heritage.

3.2 INDIAN FORESTS

Forests play an important ecological role, which affects human life directly in a number of ways. They thwart the dangers of cloud drifting, soil erosion, floods, wind erosion and ground water evaporation. They also protect a wide variety of flora and fauna.

India's population has risen from 370 million in 1947 to 880 million in 1994, constituting 18 % of the world population. India has 15 % of world's livestock, but only 2 % of the geographical area, 1% of forest area and 0.5 % of pasture lands.

India has a forest area of 64.01 mha, which constitutes only 19.5 % of the total land area as against 33 % of National Forest Policy of 1988. Per capita availability of forests in India is 0.08 ha which is much lower than the world average of 0.8 ha. Even if no further net deforestation takes place, merely on considering the increase in population, the forest area could be reduced to 0.07 hectare per capita by the year 2000 (Govt. of India ,1993). Thus, the pressure on the existing forest is quite high in India at present, with high population density and a very low per capita forest area.

The serious depletion of the country's forests is attributed to a host of factors. These include the ever increasing demand for fuelwood, fodder and timber necessitated by rapid increase in population (human as well as livestock), inadequacy of protection measures, diversion of forest lands to non-forest uses without ensuring compensatory afforestation, essential environmental safeguards, increased demand for forest-based industries and the tendency to look upon forests as revenue earning resource.

MARIGOLD GARDEN FLOWER

TABLE 3.1.1 : NUMBER OF PLANT SPECIES IN INDIA

Type	No. of Species in India (in thousands)	No. of Species in the World (thousands)	Percentage of Occurrence in India
A. **Flowering Plants**	17	250	6.80
B. **Non-flowering Plants**	28	6750	4.15
Total	45	7000	6.43

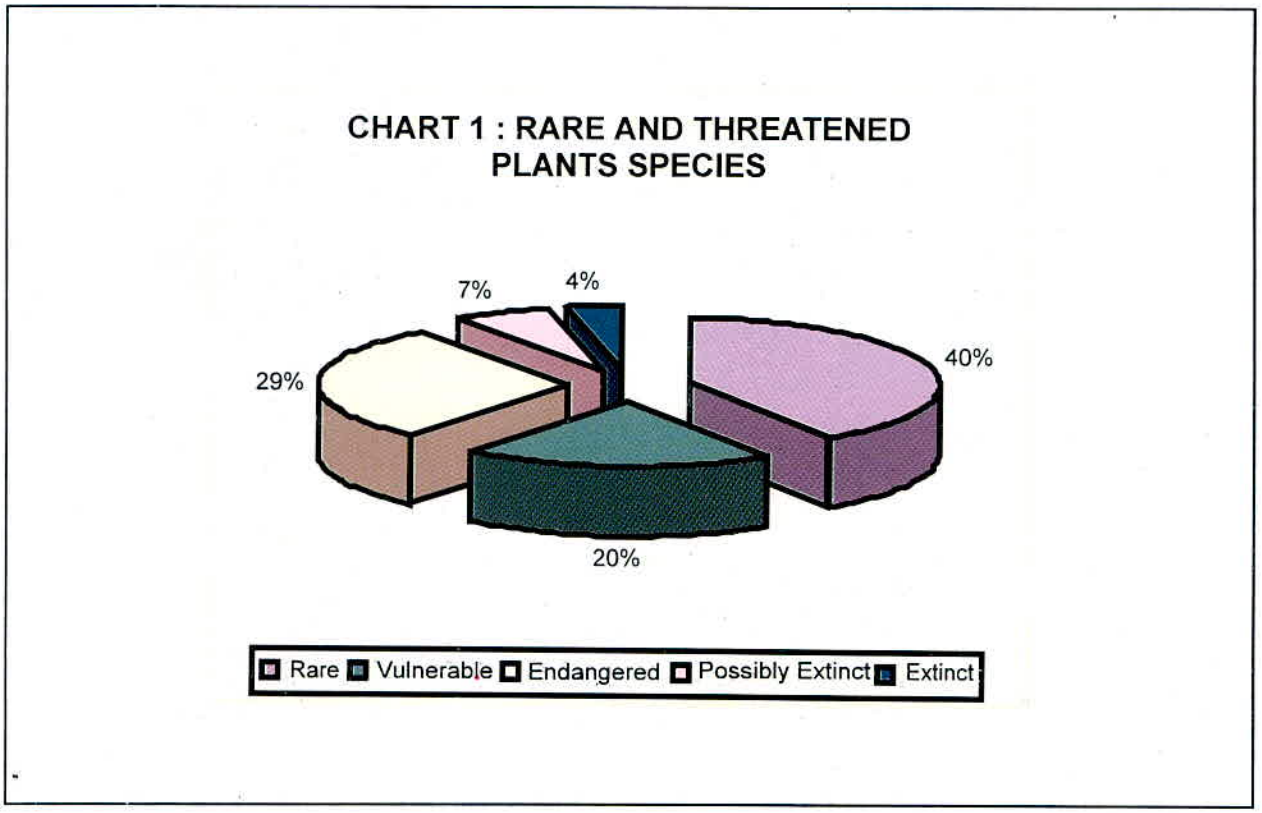
Source : Botanical Survey of India, Calcutta.

India has a rich heritage of species and genetic strains of flora. Overall about six percent of world species are found in India. It is estimated that India is tenth among the plant rich countries of the world and sixth among the centres of diversity and origin of agrodiversity. Out of the total twelve biodiversity hot-spots in the world, India has two, one is the north east region and other is western ghats (Khoshoo, T.N., 1995). The growing urbanization and industrialization costs the decrease of Natural habitats, which further results in the loss to biological diversity. Biodiversity, once lost cannot be recovered.

TABLE 3.1.2 : RARE AND THREATENED SPECIES (VASCULAR PLANTS)

Category	Approximate Number
Rare	237
Vulnerable	117
Endangered	170
Possibly Extinct	38
Extinct	21

Source : Botanical Survey of India, Calcutta.



WATER LILLY IN BOTONIC GARDEN

TABLE 3.1.3 : REFERENCE COLLECTIONS OF FLORA

Category	Total Number	Total Holdings of Collections and Specimens
1 Herbarium	59	4594595
2 Museums	18	60000

Source : Botanical Survey of India, Calcutta.

TABLE 3.1.4 : CONSERVATION MEASURES

	Category	Number	Total Geographical area (Sq. Kms.)
A.	**Within Habitats (insitu)**		
(I)	Biosphere Reserves	7	21067
(II)	National Parks	75	NA
(III)	Sanctuaries	420	140675
(IV)	Reserve Forests	NA	415896
(V)	Other Protected areas	19	29716
B.	**Outside Habitats (ex situ)**		
(I)	Botanical Gardens	120	NA
(II)	Gene Banks	NA	NA

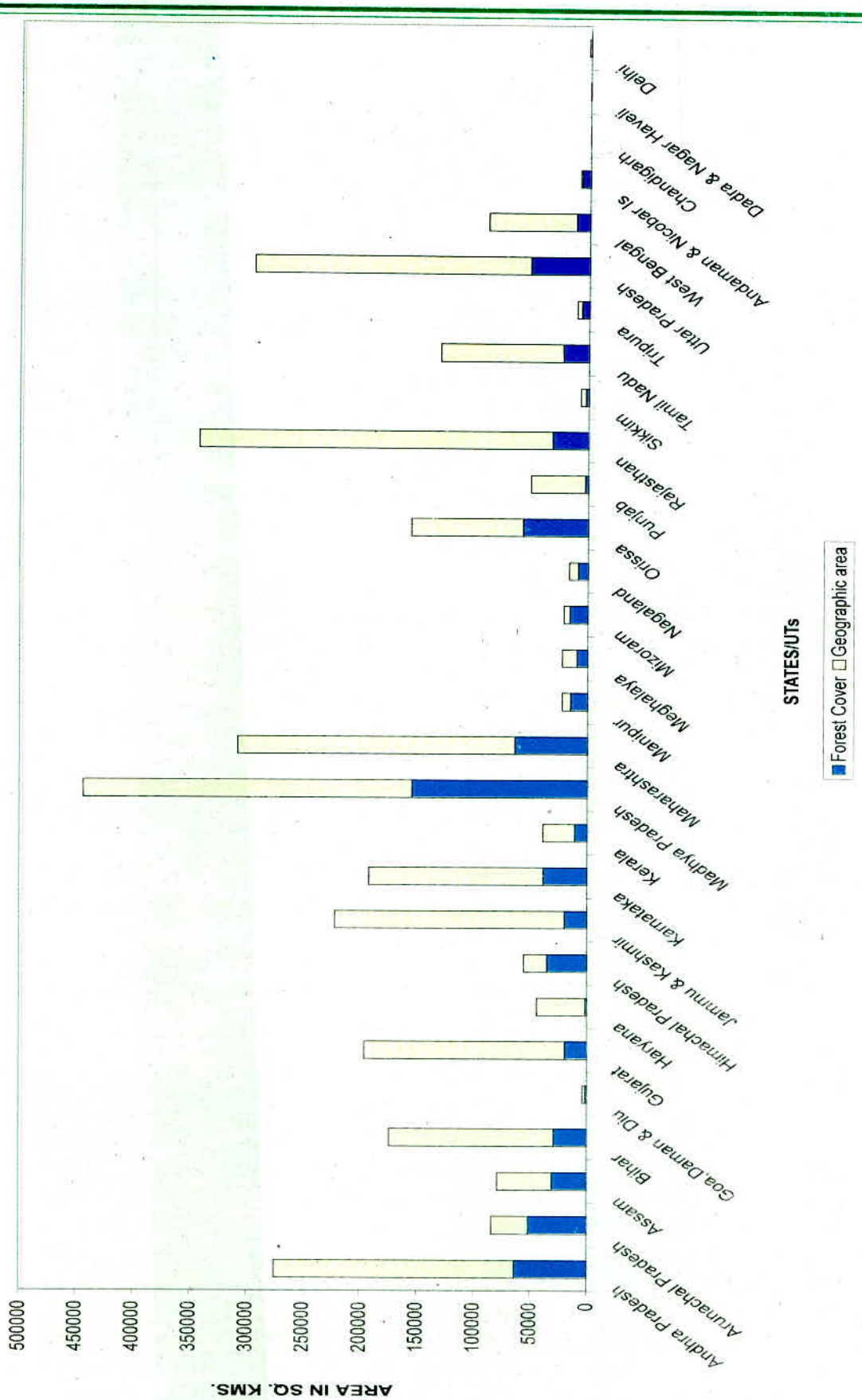
Source : Botanical Survey of India, Calcutta.

TABLE 3.1.5 : NAMES OF BIOSPHERE RESERVES IN INDIA SETUP UPTO MARCH, 1998

S.No.	Bio-geographic Region	Name of Biosphere reserve and location	Date of setting up
1	West Himalaya	Nanda Devi (Uttar Pradesh)	18.1.1988
2	N.E.India	(a) Nokrek (Meghalaya) (b) Manas (Assam) (c) Dibaru Saikhowa (Assam)	01.9.1988 14.3.1989 28.7.1997
3	Gangetic Plains	Sunderbans (West Bengal)	29.3.1989
4	Coastal	Gulf of Mannar (Tamil Nadu)	18.2.1989
5	Western Ghats	Nilgiri (Karnataka, Kerala, Tamil Nadu)	01.8.1986
6	Islands	Great Nicobar	06.1.1989
7	Deccan Peninsular	Similipal(Orissa)	21.1.1994

Source: Ministry of Environment and Forests, Annual Report, 1997-98

CHART 2 : FOREST COVER IN DIFFERENT STATES AS COMPARED TO TOTAL GEOGRAPHIC AREA



MANGROVE FORESTS

TABLE 3.2.1 : STATE/UT WISE FOREST AREA

(Area in sq.km)

S. No.	State/Uts	Geographic area	Reserved forests	Protected forests	Others	Total	% of forests to total Geographic area
1	Andhra Pradesh	275068	50479	12365	970	63814	23.20
2	Arunachal Pradesh	83743	15321	8	36211	51540	61.55
3	Assam	78438	18242	3934	8532	30708	39.15
4	Bihar	173877	5051	24168	7	29226	16.81
5	Goa	3814	165	NA	1259	1424	37.34
6	Gujarat	196024	13819	997	4577	19393	9.89
7	Haryana	44212	247	1104	322	1673	3.78
8	Himachal Pradesh	55673	1896	31473	2038	35407	63.60
9	Jammu & Kashmir	222235	20182	NA	NA	20182	9.08
10	Karnataka	191791	28611	3932	6181	38724	20.19
11	Kerala	38863	11038	183	NA	11221	28.87
12	Madhya Pradesh	443446	82700	66678	5119	154497	34.84
13	Maharashtra	307690	48373	9350	6119	63842	20.75
14	Manipur	22327	1463	4171	9520	15154	67.87
15	Meghalaya	22429	981	12	8503	9496	42.34
16	Mizoram	21081	7127	3568	5240	15935	75.59
17	Nagaland	16579	86	507	8036	8629	52.05
18	Orissa	155707	27087	30080	16	57184	36.73
19	Punjab	50362	44	1107	1750	2901	5.76
20	Rajasthan	342239	11585	16837	3278	31700	9.26
21	Sikkim	7096	2261	285	104	2650	37.34
22	Tamil Nadu	130058	19486	2528	614	22628	17.40
23	Tripura	10486	3588	509	2196	6293	60.01
24	Uttar Pradesh	294411	36425	1499	13739	51663	17.55
25	West Bengal	88752	7054	3772	1053	11879	13.38
26	Andaman & Nicobar Island	8249	2929	4242	NA	7171	86.93
27	Chandigarh	114	31	NA	NA	31	27.19
28	Dadra & Nagar Haveli	491	203	NA	NA	203	41.36
29	Delhi	1483	42	NA	NA	42	2.83
30	Lakshadweep	32	NA	NA	NA	NA	NA
31	Pondicherry	493	NA	NA	NA	NA	NA
Total		3287263	416516	223310	125384	765209	23.28

Source: Forest Survey of India, The State of Forest Report 1997

India has a forest cover of 76.52 million hectares of recorded forest area, while only 63.34 million hectares can be classified as actual forest cover. This accounts for 23.28% of total geographic area against 33% recommended by National Forest Policy of 1988. Per Capita availability of forests in India is 0.08 ha which is much lower than the world average of 0.8 ha. Even if no further net deforestation takes place, merely on considering the increase in population, the forest area could be reduced to 0.07 ha per capita by the year A.D. 2000 (Government of India, 1993)

TABLE 3.2.2 : STATEWISE AREA UNDER FOREST BY COMPOSITION AND LEGAL STATUS

(Area in sq.km)

State/ Union Territory	Recorded Forest Area	Area by Composition			Area by Legal status		
		Coniferous	Non-coniferous		Reserve Forest	Protected Forest	Unclassed Forest
			Mangroves	Others			
States :							
Andhra Pradesh	63813.73	-----	317.00	63497.00	50478.63	12365.34	969.76
Arunachal Pradesh	51540.00	-----	-----	-----	9815.37	7.79	41716.84
Assam	30707.57	-----	-----	-----	18242.24	3933.62	8531.71
Bihar	29236.19	-----	-----	29236.19	5051.43	24177.67	7.09
Goa(1)	1424.38 #	-----	20.00	1404.38	135.71	200.00	1088.67
Gujarat	19392.47	-----	-----	-----	13820.01	995.31	4577.15
Haryana	1673.00	23.00	-----	1650.00	247.00	1104.00	322.00
Himachal Pradesh	35327.00	8339.00	-----	27068.00	1816.00	31473.00	2038.00
Jammu & Kashmir	20182.00	8127.00	-----	12055.00	19464.00	718.00	0.00
Karnataka	38723.56 $	-----	60.00	38663.56	28610.53	3932.17	6180.86
Kerala	11221.00	-----	-----	154496.67	11221.00		
Madhya Pradesh	154496.70	-----	-----	63899.00	82700.13	66677.57	5119.00
Maharashtra	64012.00	-----	130.00	-----	48551.00	9350.00	6111.00
Manipur	15154.00	-----	-----	732.94	-----	-----	-----
Meghalaya	9496.00	145.14	-----	10749.00	713.12	12.39	152.57
Mizoram	14249.00	3500.00	-----		7709.00	1300.00	5240.00
Nagaland	8625.00	-----	-----	56984.58	-----	-----	-----
Orissa	57183.57	3.99	195.00	2779.00	27087.34	30080.30	15.93
Punjab	2901.00	122.00	-----	31699.67	44.00	1107.00	1750.00
Rajasthan	31699.67	-----	-----	1779.20	11585.23	16836.51	3277.93
Sikkim	2729.00	949.80	-----	17664.00	2261.00	-----	468.00
Tamil Nadu	22628.00	-----	47.00	6292.68	19486.00	2528.00	614.00
Tripura	6292.68	-----	-----	35518.29	3588.18	509.03	2195.47
Uttar Pradesh	41083.67	5565.38	-----	9671.00	36424.56	1499.06	3160.05
West Bengal	11879.00	89.00	2119.00	-----	7054.00	3772.00	1053.00
Union Territory :							
A&N Islands	7171.00	-----	-----	-----	-----	-----	-----
Chandigarh	31.00	-----	-----	-----	-----	-----	-----
D&N Haveli	201.77	-----	-----	201.77	199.67	2.10	-----
Daman & Diu (1)	-----	-----	-----	-----	-----	-----	-----
Delhi	42.00	-----	-----	-----	-----	-----	-----
Lakshadweep	-----	-----	-----	-----	-----	-----	-----
Pondicherry	-----	-----	-----	-----	-----	-----	-----
All India	**753005.00**	**26864.31**	**2871.00**	**566041.93**	-----	-----	-----

\# Including 200 Sq. km. Area of private land.

$ Including 308.42 Sq. Km. Of private and 124.20 Sq. Km. Of village.

(1) Figures of Daman and Diu are included in Goa.

Note : Data relate to SFD - 1994.

Source : Forestry Statistics India, 1995

TABLE 3.2.3 : COMPARATIVE SITUATION OF FOREST COVER IN INDIA

(Area in sq.km)

S.No.	State/Uts	1997 Assessment	1995 Assessment	1993 Assessment	Changes in 1997	Changes in 1995
1	Andhra Pradesh	43290	47112	47256	-3822	-144
2	Arunachal Pradesh	68602	68621	68661	-19	-40
3	Assam	23824	24061	24508	-237	-447
4	Bihar	26524	26561	26587	-37	-26
5	Delhi	26	26	22	0	4
6	Goa,Daman & Diu	1255	1250	1250	5	0
7	Gujarat	12578	12320	12044	258	276
8	Haryana	604	603	513	1	90
9	Himachal Pradesh	12521	12501	12502	20	-1
10	Jammu & Kashmir	20440	20433	20443	7	-10
11	Karnataka	32403	32382	32343	21	39
12	Kerala	10334	10336	10336	-2	0
13	Madhya Pradesh	131195	135164	135396	-3969	-232
14	Maharashtra	46143	43843	43859	2300	-16
15	Manipur	17418	17558	17621	-140	-63
16	Meghalaya	15657	15714	15769	-57	-55
17	Mizoram	18775	18576	18697	199	-121
18	Nagaland	14221	14291	14348	-70	-57
19	Orissa	46941	47107	47145	-166	-38
20	Punjab	1387	1342	1343	45	-1
21	Rajasthan	13353	13280	13099	73	181
22	Sikkim	3129	3127	3119	2	8
23	Tamil Nadu	17064	17045	17726	19	-681
24	Tripura	5546	5538	5538	8	0
25	Uttar Pradesh	33994	33986	33961	8	25
26	West Bengal	8349	8276	8186	73	90
27	Andaman & Nicobar Islands	7613	7615	7624	-2	-9
28	Chandigarh	7	7	5	0	2
29	Dadra & Nagar Haveli	204	204	206	0	-2
30	Lakshadweep	NA	NA	NA		
31	Pondicherry	NA	NA	NA		
Total		633397	638879	640107	-5482	-1228

Source: Forest Survey of India, The State of Forest Report 1997

In the year 1997, as compared to 1995, the total forest cover has decreased by 5482 Sq. Kms. The states which have shown significant decrease in the forest covers are Arunachal Pradesh, Assam, Madhya Pradesh, and Orrisa. Whereas the states of Gujarat, Maharashtra, Mizoram, Punjab, West Bengal and Rajasthan have shown an increase in forest cover.

COLLECTION OF MINOR FOREST PRODUCE (SAL SEEDS) IN BASTER, MADHYA PRADESH

TABLE 3.2.4 : FOREST PRODUCTS OF INDIA

Forest Produce		1981	1983	1984	1985	1986	1987	1988	1989	1990	1991
Roundwood	C	8236 $	8714 $	8965 $	9220 $	9360 $	9500 $	9641 $	9786 $	9933 $	10086 $
	NC	208865 $	219027 $	224242 $	229553 $	234105 $	238662 $	243264 $	247951 $	252755 $	257697 $
Fuelwood	C	5913 $	6183 $	6322 $	6461 $	6599 $	6739 $	6877 $	7020 $	7165 $	7316 $
	NC	190726 $	199431 $	203900 $	208371 $	212831 $	217296 $	221804 $	226396 $	231103 $	235945 $
Industrial	C	2323 $	2531 $	2643 $	2759 $	2761 $	2763 $	2764 $	2766 $	2768 $	2780 $
roundwood	NC	18139 $	19596 $	20372 $	21182 $	21274 $	21366 $	21460 $	21555 $	21652 $	21752 $
Pulpwood	C	145 $	145 $	145 $	145 $	145 $	145 $	145 $	145 $	145 $	145 $
	NC	1063 $	1063 $	1063 $	1063 $	1063 $	1063 $	1063 $	1063 $	1063 $	1063 $
Sawnwood	C	1753 $	2091 $	2266 $	2500 $	2500 $	2500 $	2500 $	2500 $	2500 $	2500 $
	NC	1028 $	12404 $	13621 $	14960 $	14960 $	14960 $	14960 $	14960 $	14960 $	14960 $
Wood based panels		357	384	442	442 $	899	442 $	442 $	442 $	442 $	442 $
Veneer sheets		4 $	4 $	4 $	4 $	4 $	4 $	4 $	4 $	4 $	4 $
Plywood		280 *	300 *	360 *	360 $	360 $	360 $	360 $	360 $	360 $	360 $
Particle Board		31 *	30 *	32 *	32 $	32 $	32 $	32 $	32 $	32 $	32 $
Fibre Board	Comp.	39 $	47 $	43 $	43 $	43 $	43 $	43 $	43 $	43 $	43 $
	Non-comp.	3 $	3 $	3 $	3 $	460	3 $	3 $	3 $	3 $	3 $
Woodpulp		513	768	799	864	887	1000 $	1000 $	1000 $	1000 $	1000 $
Newsprint		50	170	193	190 *	260	300	330	330	295 *	300 *
Printing/writing paper		710	815	805	750 *	850 *	860 *	860 $	860 $	1150 *	1150 *

$: FAO estimates
* : Unofficial data
C : Coniferous
NC : Non-coniferous
Comp. : Compressed

Source : Forestry Statistics, India, 1995

TABLE 3.2.5 : ESTIMATES OF GROWING STOCK IN INDIA BASED ON THE FOREST COVER AREA AND INVENTORY RESULTS

S. No.	Name of State/UT	Forest Cover Area			Estimated total growing stock				
		Dense Forest (sq.km)	Open Forest (sq.km)	Total Forest (sq.km)	Dense Forest (000cu m)	Open Forest (000cu m)	Total Forest (mill cu m)	Overall Volume per ha (cu m)	%age of growing stock to total
1	Andhra Pradesh	25008	22248	47256	211265	80129	291.39	61.66	6.15
2	Arunachal Pradesh	54510	14151	68661	702969	72156	775.13	112.80	16.35
3	Assam	15998	8510	24508	248057	56366	304.42	124.20	6.42
4	Bihar	13172	13415	26587	65634	31086	96.72	36.38	2.04
5	Goa, Daman & Diu	995	255	1250	12235	409	12.64	101.16	0.27
6	Gujarat	6301	5743	12044	42633	21288	63.92	53.07	1.35
7	Haryana	329	184	513	1266	166	1.43	27.92	0.03
8	Himachal Pradesh	9565	2937	12502	237030	17380	254.41	203.50	5.37
9	Jammu & Kashmir	10953	9490	20443	328543	130386	458.93	224.49	9.68
10	Karnataka	24852	7491	32343	250249	22162	272.41	84.23	5.75
11	Kerala	8421	1915	10336	82082	16801	98.88	95.67	2.08
12	Madhya Pradesh	95537	39859	135396	592931	105251	698.18	51.56	14.73
13	Maharashtra	25680	18179	43859	173740	51814	225.55	51.43	4.76
14	Manipur	5307	12314	17621	59309	36143	95.45	54.10	2.01
15	Meghalaya	3305	12464	15769	51024	53116	104.14	66.00	2.20
16	Mizoram	4238	14459	18697	29487	36525	66.01	35.30	1.39
17	Nagaland	3487	10861	14348	42622	52265	94.89	66.10	2.00
18	Orissa	27151	19994	47145	183737	62413	246.15	52.21	5.19
19	Punjab	481	862	1343	556	394	0.95	7.07	0.02
20	Rajasthan	3581	9518	13099	6107	6785	12.89	9.84	0.27
21	Sikkim	2395	724	3119	35032	4254	39.29	125.90	0.83
22	Tamil Nadu	9422	8304	17726	49283	20319	69.60	39.31	1.47
23	Tripura	1819	3719	5538	6219	9233	15.45	27.90	0.33
24	Uttar Pradesh	22965	10996	33961	300889	37744	338.63	99.71	7.14
25	West Bengal	3362	2705	6067	21257	1602	22.86	37.68	0.48
26	Andaman&Nicobar Island	6567	91	6658	79247	397	79.64	119.62	1.68
27	Chandigarh	4	1	5	NA	NA	NA	NA	NA
28	Dadra & Nagar Haveli	159	47	206	817	54	0.87	42.20	0.02
29	Delhi	12	10	22	NA	NA	NA	NA	NA
30	Lakshadweep	NA	NA	NA	NA	NA	NA	NA	NA
31	Pondicherry	NA	NA	NA	NA	NA	NA	NA	NA
	Total (Excluding Mangrove forests)	385576	251446	637022	3814220	926638	4740.86	74.42	100.00

Source: Forest Survey of India: Extent,Composition,Density,Growing Stock and Annual Increment of India's Forests(1995)

TABLE 3.2.6 : ESTIMATES OF WASTELANDS IN INDIA.

(Area in Lakh Sq.km)

States/Uts.	Non Forest Degraded Area	Forest Degraded Area	Total
Andhra Pradesh	0.7682	0.3734	1.1416
Assam	0.0935	0.0795	0.1730
Bihar	0.3896	0.1562	0.5458
Gujrat	0.7153	0.0683	0.7836
Haryana	0.2401	0.0074	0.2475
Himachal Pradesh	0.1424	0.0534	0.1958
Jammu & Kashmir	0.0531	0.1034	0.1565
Karnataka	0.7122	0.2043	0.9165
Kerala	0.1053	0.0226	0.1279
Madhya Pradesh	1.2947	0.7195	2.0142
Maharashtra	1.1560	0.2841	1.4401
Manipur	0.0014	0.1424	0.1438
Meghalaya	0.0815	0.1103	0.1918
Nagaland	0.0508	0.0878	0.1386
Orissa	0.3157	0.3227	0.6384
Punjab	0.1151	0.0079	0.1230
Rajasthan	1.8010	0.1933	1.9943
Sikkim	0.0131	0.0150	0.0281
Tamilnadu	0.3392	0.1009	0.4401
Tripura	0.0108	0.0865	0.0973
Uttar Pradesh	0.6635	0.1426	0.8061
West Bengal	0.2177	0.0359	0.2536
Uts	0.0889	0.2715	0.3604
Total	**9.3691**	**3.5889**	**12.9580**

Source : Forestry Statistics India,1995

CHART 3 : FOREST AND NON-FOREST DEGRADED AREA

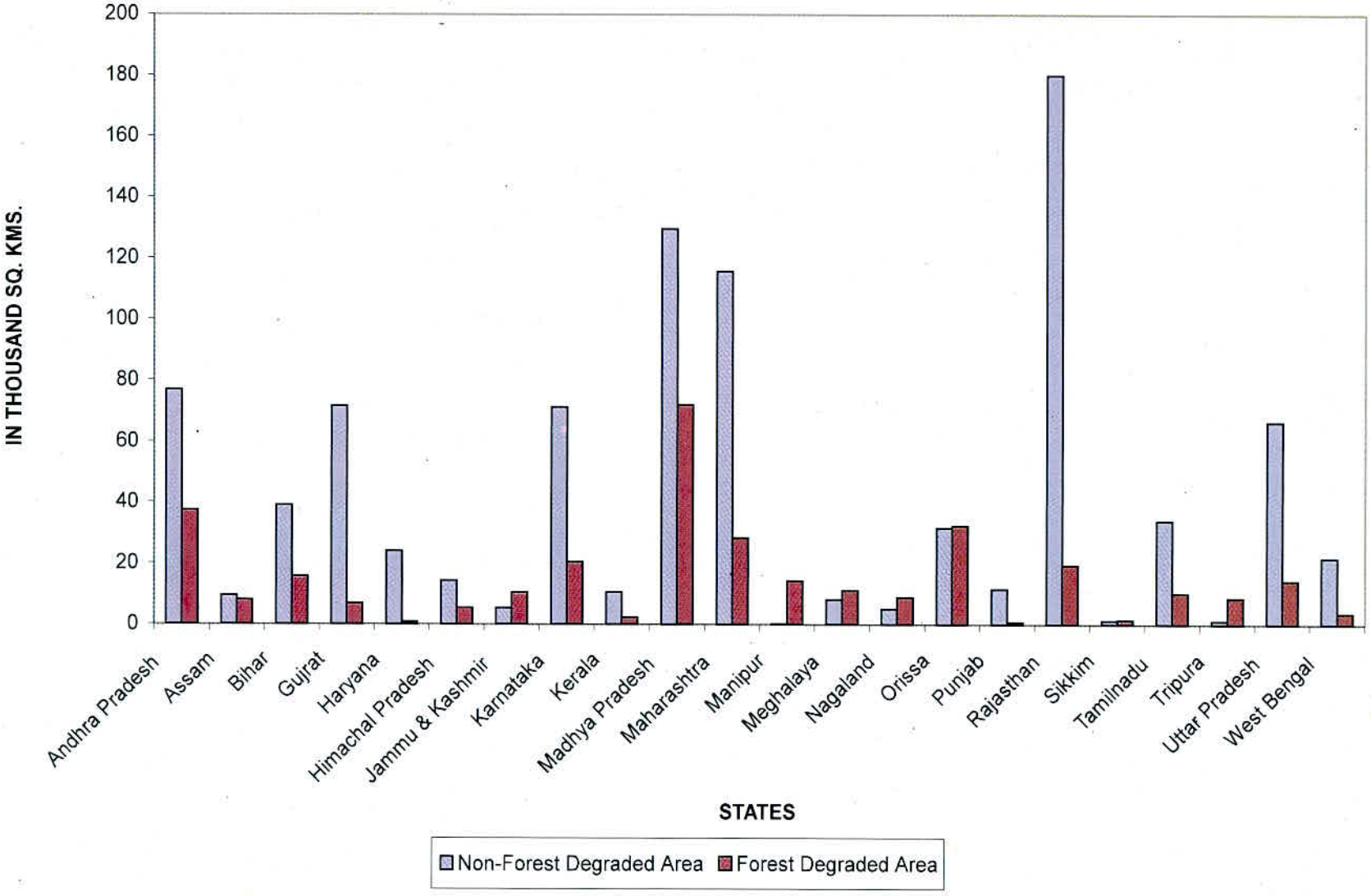


TABLE 3.2.7 : ESTIMATES OF NON-FOREST WASTELANDS IN INDIA

(Area in Lakh Sq.km)

States/Uts.	Saline & Alkaline Lands	Wind Eroded Area	Water Eroded Area	Total
Andhra Pradesh	0.0240	....	0.7442	0.7682
Assam	....	....	0.0935	0.0935
Bihar	0.0004	....	0.3892	0.3896
Gujarat	0.1214	0.0704	0.5235	0.7153
Haryana	0.0526	0.1599	0.0276	0.2401
Himachal Pradesh	....	....	0.1424	0.1424
Jammu & Kashmir	....	....	0.0531	0.0531
Karnataka	0.0404	....	0.6718	0.7122
Kerala	0.0016	....	0.1037	0.1053
Madhya Pradesh	0.0242	....	1.2705	1.2947
Maharashtra	0.0534	....	1.1026	1.1560
Manipur	....	....	0.0014	0.0014
Meghalaya	....	....	0.0815	0.0815
Nagaland	....	....	0.0508	0.0508
Orissa	0.0404	....	0.2753	0.3157
Punjab	0.0688	....	0.0463	0.1151
Rajasthan	0.0728	1.0623	0.6659	1.8010
Sikkim	....	....	0.0131	0.0131
Tamilnadu	0.0004	....	0.3388	0.3392
Tripura	....	....	0.0108	0.0108
Uttar Pradesh	0.1295	....	0.5340	0.6635
West Bengal	0.0850	....	0.1327	0.2177
Uts	0.0016	....	0.0873	0.0889
Total	**0.7165**	**1.2926**	**7.3600**	**9.3691**

Source : Forestry Statistics India, 1995.

CLEARING FOREST FOR CULTIVATION BY TRIBALS IN BASTER

TABLE 3.2.8 : DIVERSION OF FOREST LAND FOR NON FOREST USE SINCE THE ENFORCEMENT OF FOREST CONSERVATION ACT,1980

(Area in sq.km)

Year	Forest land Diversion
1980	Nil
1981	26.7204
1982	32.4654
1983	57.0201
1984	78.3759
1985	106.0807
1986	119.6311
1987	727.8005
1988	187.6535
1989	203.6505
1990	1385.5138 *
1991	6.2521
1992	56.8694
1993	117.8564
1994	135.2769

Source : Forestry Statistics India, 1995

* Includes :

I. 1030 Sq. Kms. for regularisation of encroachments in MP

II. 120 Sq. Kms. for field firing range of Indian Army in Sagar

CHART 4 : FOREST LAND DIVERSION

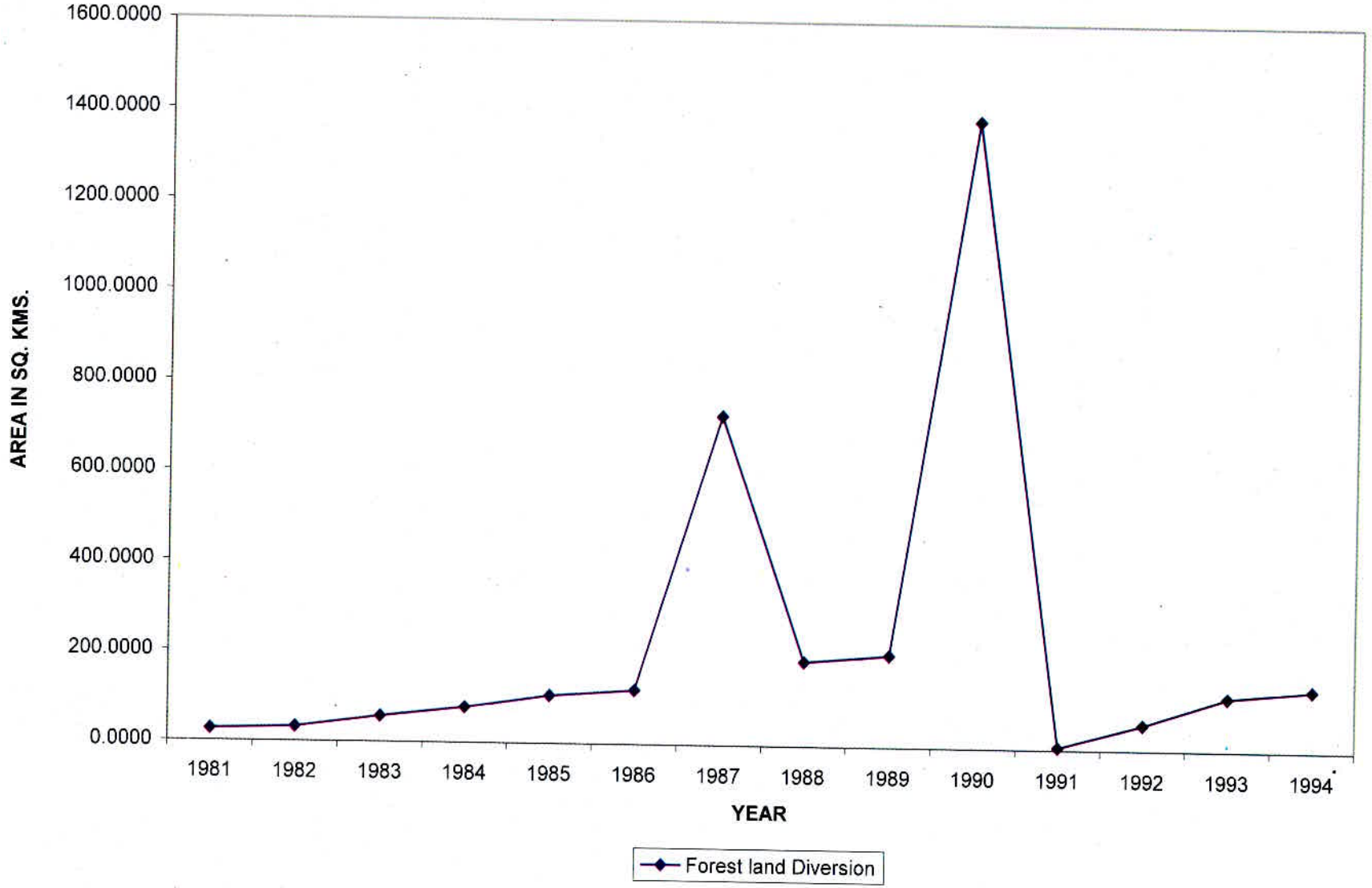


TABLE 3.2.9 : PHYSICAL AND FINANCIAL COMPONENTS OF EXTERNALLY AIDED SOCIAL FORESTRY PROJECTS.

Physical(P): In Hectares **Financial (F): Rs. In Millions**

S. No	Name of the project	Donor Agency	Project Period	Project Cost	Type	Project		
						Farm Forestry	Village Woodlot	Stripe Plantation
1	NSFP Uttar Pradesh	WB USAID	5 Years	1611.60	P	147210.00	1400.00	740.00
					F	536.20	150.40	17.20
2	NSFP Gujarat	WB USAID	5 Years	1296.50	P	230500.00	35000.00	17500.00
					F	143.60	363.80	630.80
3	NSFP Himachal Pradesh	WB USAID	5 Years	572.90	P	66838.00	41000.00	
					F	139.30	201.20	
4	NSFP Rajasthan	WB USAID	5 Years	391.90	P	91500.00	500.00	4300.00
					F	121.80	30.20	113.10
5	SFP Haryana	WB DANIDA	1982-83 to 1989-90	333.25	P	30000.00	12000.00	9500.00
					F	25.65	46.39	45.35
6	SFP Jammu & Kashmir	WB DANIDA	1982-83 to 1989-90	237.40	P	19000.00	5000.00	3000.00
					F	17.40	17.00	11.70
7	SFP Karnataka	WB (UK)	1983-84 to 1987-88	552.30	P	120500.00	25000.00	4000.00
					F	180.00	98.50	9.30
8	SFP Kerala	WB	1984-85 to 1989-90	599.11	P	69200.00	14100.00	2000.00
					F	162.25	183.43	
9	SFP West Bengal	WB	1981-82 to 1989-90	348.65	P	52000.00	6000.00	20000.00
					F	18.84	17.84	91.47
10	Bihar Social Forestry Project	SIDA	1985-86 to 1990-91	538.57	P	71750.00	30750.00	1200.00
					F	156.28	21.52	18.00
11	SFP Orissa							
	Phase I	SIDA	1983-84 to 1987-88	281.70	P	26500.00	21700.00	
					F	11.60	170.70	
	Phase II	SIDA	1988-89 to 1992-93	783.40	P	62000.00	52500.00	650.00
					F	253.60	222.30	2.20
12	SFP, (TN)							
	Phase I	SIDA	1981-82 to 1987-88	591.38	P	85165.00	131405.00	7925.00
					F	50.80	178.94	39.46
	Phase II	SIDA	1988-89 to 1992-93	854.00	P	18000.00	56300.00	
					F	154.40	247.50	
13	SFP Andhra Pradesh	SIDA	1983-84 to 1989-90	383.78	P	108100.00	25000.00	3785.00
					F	68.78	61.03	62.28
14	SFP Maharashtra	USAID	1982-83 to 1989-90	564.00	P	44035.00	33975.00	2990.00
					F	257.74		
	Total			9940.44	P	1242293.00	508730.00	77590.00
					F	2090.50		3971.67

Source: Forestry Statistics India, 1995

Table 3.2.9 continued.....

TABLE 3.2.9 : PHYSICAL AND FINANCIAL COMPONENTS OF EXTERNALLY AIDED SOCIAL FORESTRY PROJECTS.

Physical(P): In Hectares **Financial (F): Rs. In Millions**

S. No	Name of the project	Type	COMPONENTS			
			Ref./Reh of Degraded Forests	Support Activities	Organisational Functions	Total
1	NSFP	P				161950.00
	Uttar Pradesh	F		216.60	641.20	1611.60
2	NSFP	P	30400.00			313400.00
	Gujarat	F		32.40	119.90	1296.50
3	NSFP	P	5000.00			112833.00
	Himachal Pradesh	F	24.60	49.30	158.40	572.90
4	NSFP	P	20000.00			120800.00
	Rajasthan	F		37.30	89.50	391.90
5	SFP	P	15500.00			67000.00
	Haryana	F	43.39	9.80	88.30 *	333.25
6	SFP	P	17000.00			44000.00
	Jammu & Kashmir	F	64.20	14.50	58.80**	237.40
7	SFP	P				149500.00
	Karnataka	F		8.30	157.70	552.30
8	SFP	P				85300.00
	Kerala	F		18.77	234.66	599.11
9	SFP	P	15000.00			93000.00
	West Bengal	F	51.04	7.38	72.84 #	348.65
10	Bihar Social	P	64500.00			168200.00
	Forestry Project	F	131.30	16.00	195.47	538.57
11	SFP Orissa					
	Phase I	P	35300.00			134400.00
		F		11.65	87.75	281.70
	Phase II	P	19250.00			83500.00
		F	65.60	41.50	198.20	783.40
12	SFP, (TN)					
	Phase I	P				224495.00
		F	170.94	18.63	132.61	591.38
	Phase II	P	4080.00			78380.00
		F	25.80	45.50	260.40 @	854.00
13	SFP	P	13840.00			150725.00
	Andhra Pradesh	F	82.45	11.86	97.38	383.78
14	SFP	P				81000.00
	Maharashtra	F		47.01	259.25	564.00
Total		P	239870.00			2068483.00
		F		586.50	3288.77	F9940.44

Source: Forestry Statistics India, 1995

Note 1. Farm Forestry Components include Notional conversion @ 2000 seedlings/ha for seedling distribution.

2. The totals relate to period 1981-82 to 1992-93

\# + 89.24 Price escalation & contengencies

* + 74.37 Price escalation & contengencies

** + 53.80 Price escalation & contengencies

@ + 120.40 Unallocated

TABLE 3.3.1 : INDIA'S MAJOR BIOGEOGRAPHIC HABITATS

S.No.	Biogeographic Zone	Biotic Province	Total area(Sq.Km)
1	Trans-Himalayan	Upper Regions	186200
2	Himalayan	North-West Himalayas	69000
		West Himalayas	72000
		Central Himalayas	123000
		East Himalayas	83000
3	Desert	Kutch	45000
		Thar	180000
		Ladakh	NA
4	Semi-Arid	Central India	107600
		Gujarat-Rajwara	400400
5	Western Ghats	Malabar Coast	59700
		Western Ghat Mountains	99300
6	Deccan Peninsula	Daccan Plateau South	378000
		Central Plateau	341000
		Eastern Plateau	198000
		Chhota Nagpur	217000
		Central Highlands	287000
7	Gangetic Plain	Upper Gangetic Plain	206400
		Lower Gangetic Plain	153000
8	North-East India	Brahmaputra Valley	65200
		North-Eastern Hills	106200
9	Islands	Andaman Islands	6397
		Nicobar Islands	1930
		Lakshadweep Islands	180
10	Coasts	West Coast	6500
		East Coast	6500

Source : "Conserving our Biological Wealth", WWF for Nature-India and Zoological Survey of India

TABLE 3.3.2 : ESTIMATED NUMBER OF SPECIES

Group	India	World	% in India
Protozoa	2577	31250	8.25
Porifera	519	5100	10.18
Siphonophora	118	180	65.56
Sclerectinia	119	7000	1.70
Ctenophora	10	100	10.00
Platyhelminthes	1622	17500	9.27
Turbellaria	*47*	*4000*	*1.18*
Monogenea	*295*	*2500*	*11.80*
Trematoda	*750*	*6500*	*11.54*
Cestoda	*530*	*4500*	*11.78*
Rotifera	310	2500	12.40
Gastrotricha	88	2500	3.52
Kinorhyncha	10	100	10.00
Nematoda	2350	25000	9.40
Acanthocephala	110	800	13.75
Sipuncula	38	202	18.81
Mollusca	5042	80000	6.30
Echiura	33	127	25.98
Annelida	1093	12620	8.66
Oligochaeta	*585*	*4000*	*14.63*
Polychaeta	*428*	*8000*	*5.35*
Hirudinea	*59*	*500*	*11.80*
Archiannelida	*21*	*120*	*17.50*
Onychophora	1	100	1.00
Arthropoda	57525	952116	6.04
Crustacea	*2970*	*24375*	*12.18*
Anostraca	*72*	*175*	*41.14*
Notostraca	*11*	*15*	*73.33*
Conchostraca	*27*	*180*	*15.00*
Cladocera	*90*	*400*	*22.50*
Ostracoda	*120*	*2000*	*6.00*
Copepoda	*540*	*4500*	*12.00*
Branchiura	*4*	*75*	*5.33*

Table 3.3.2 continued....

TABLE 3.3.2 : ESTIMATED NUMBER OF SPECIES

Group	India	World	% in India
Cirripedia	*104*	*750*	*13.87*
Isopoda	*200*	*4000*	*5.00*
Amphipoda	*143*	*3600*	*3.97*
Decapoda	*1535*	*8500*	*18.06*
Stomatopoda	*124*	*180*	*68.89*
Insecta	50717	839052	6.04
Thysanura	*23*	*1250*	*1.84*
Diplura	*16*	*355*	*4.51*
Protura	*20*	*260*	*7.69*
Collembola	*200*	*5000*	*4.00*
Ephemeroptera	*94*	*2146*	*4.38*
Odonata	*491*	*5500*	*8.93*
Plecoptera	*113*	*2100*	*5.38*
Orthoptera	*759*	*14491*	*5.24*
Phasmida	*60*	*2500*	*2.40*
Dermaptera	*320*	*1800*	*17.78*
Embioptera	*33*	*200*	*16.50*
Blattaria	*156*	*4200*	*3.71*
Mantodea	*161*	*2000*	*8.05*
Isoptera	*300*	*2000*	*15.00*
Psocoptera	*85*	*2500*	*3.40*
Phthiraptera	*400*	*3000*	*13.33*
Hemiptera	*6500*	*80000*	*8.13*
Thysanoptera	*691*	*6000*	*11.52*
Neuroptera	*315*	*5000*	*6.30*
Coleoptera	*15000*	*350000*	*4.29*
Strepsiptera	*8*	*300*	*2.67*
Mecoptera	*15*	*350*	*4.29*
Siphonaptera	*52*	*2000*	*2.60*
Diptera	*6093*	*96600*	*6.31*
Lepidoptera	*13000*	*142500*	*9.12*
Trichoptera	*812*	*7000*	*11.60*

Table 3.3.2 continued....

TABLE 3.3.2 : ESTIMATED NUMBER OF SPECIES

Group	India	World	% in India
Hymenoptera	*5000*	*100000*	*5.00*
Diplopoda	162	7500	2.16
Chilopoda	100	3000	3.33
Xiphosura	2	4	50.00
Arachnida	409	6385	6.41
Scorpionida	*102*	*1500*	*6.80*
Pedipalpida	*25*	*85*	*29.41*
Solpugida	*15*	*900*	*1.67*
Opiliones	*167*	*1600*	*10.44*
Pseudoscorpionida	*100*	*2300*	*4.35*
Acari	1915	36800	5.20
Araneae	1250	35000	3.57
Phoronida	3	11	27.27
Bryozoa	170	20000	0.85
Entoprocta	10	60	16.67
Brachiopoda	3	300	1.00
Cheatognatha	30	100	30.00
Echinodermata	765	6226	12.29
Hemichordata	12	118	10.17
Chordata	4894	47674	10.27
Protochordata	*116*	*2173*	*5.34*
Pisces	*2546*	*21723*	*11.72*
Amphibia	*204*	*5145*	*3.97*
Reptilia	*428*	*5375*	*7.96*
Aves	*1228*	*9026*	*13.61*
Mammalia	*372*	*4232*	*8.79*
Grand Total	**77452**	**1211584**	**6.39**

Source : Animal Resources of India

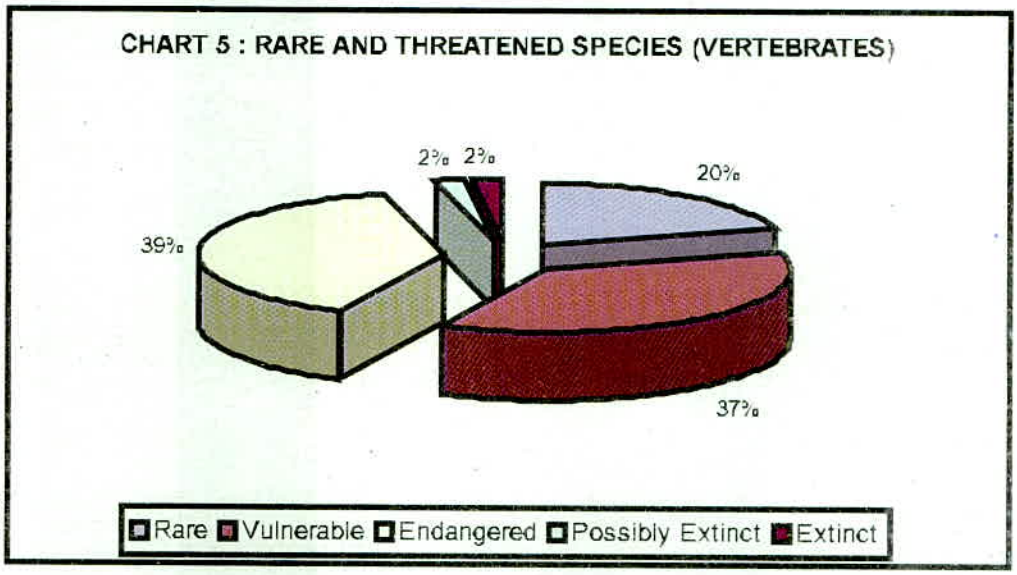
TABLE 3.3.3 : RARE AND THREATENED SPECIES(VERTEBRATES)

Category	Approximate Number
Rare	32
Vulnerable	58
Endangered	62
Possibly Extinct	3
Extinct	3

Critical Species: Brownanttlered deer, Hispid hare and Jordon's Crouser

Extinct : Cheetah, Pink Headed Duck and Mountain Quail

Source : Zoological Survey of India



RED PANDA

TABLE 3.3.4 : ENDEMIC AND THREATENDED SPECIES

Faunal Groups	Total No.	Species		Threatened
		Endemic	Percentage	
Mammals	372	38	10.21	77*
Birds	1228	69	5.61	55*
Reptiles	446	214	47.98	22*
Amphibias	204	110	53.92	1
Insects	53430	16214	30.34	—
Molluscs				
Land	1511	878	58.10	—
Freshwater	212	89	41.98	—

*Source : Red Data Book, ZSI, 1994

Source : ZSI ENVIS Newsletter, 4(182), 1997

TABLE 3.3.5 : NATIONAL PARKS AND WILDLIFE SANCTUARIES OF INDIA

S.No.	State	National Parks		Wildlife Sanctuaries	
		Number	Area(sq Km.)	Number	Area(sq Km.)
1	Andhra Pradesh	1	352.62	20	12084.59
2	Arunachal Pradesh	2	2468.23	9	6777.75
3	Assam	2	930.00	9	1381.58
4	Bihar	2	567.32	19	4624.30
5	Goa	1	107.00	4	335.43
6	Gujarat	4	479.67	21	16744.27
7	Haryana	1	1.43	9	229.18
8	Himachal Pradesh	2	1295.00	29	4576.92
9	Jammu & Kashmir	4	3810.07	16	10163.67
10	Karnataka	5	2472.18	20	4229.21
11	Kerala	3	536.52	12	1810.36
12	Madhya Pradesh	11	6143.12	32	10847.29
13	Maharashtra	5	956.45	24	14309.51
14	Manipur	2	81.80	1	184.85
15	Meghalaya	2	386.70	3	34.21
16	Mizoram	2	250.00	3	720.00
17	Nagaland	1	202.02	3	34.35
18	Orissa	2	1212.70	17	6175.49
19	Punjab	Nil	Nil	6	294.82
20	Rajasthan	4	3856.53	22	5694.02
21	Sikkim	1	850.00	4	161.10
22	Tamil Nadu	5	307.86	13	2527.29
23	Tripura	Nil	Nil	4	603.62
24	Uttar Pradesh	7	5409.05	28	8078.52
25	West Bengal	5	1692.65	16	1064.29
26	Andaman & Nicobar Islands	6	315.61	94	437.16
27	Chandigarh	Nil	Nil	1	25.42
28	Dadra & Nagar Haveli	Nil	Nil	Nil	Nil
29	Daman & Diu	Nil	Nil	1	2.18
30	Delhi	Nil	Nil	1	13.20
31	Lakshadweep	Nil	Nil	Nil	Nil
32	Pondicherry	Nil	Nil	Nil	Nil
Total		80	34684.53	441	114164.58

Source: Forest Survey of India,The State of Forest Report 1995

The Wildlife (Protection) Act, 1972 provided for setting up National Parks and Sanctuaries for Wildlife. The basic idea of these National Parks and Sanctuaries is to provide natural habitats for the Wildlife. The aim is not only to protect and preserve what remains of wild fauna and flora but also to augment this price-less national heritage.

In India, at present there are 441 Wildlife Sanctuaries and 80 National Parks, covering an area of 148849.11 Sq. Kms.

TABLE 3.3.6 : ALL INDIA TIGER POPULATION

S. No.	Name of State	Years		% change in tiger population
		1989	1993	
1	Andhra Pradesh	235	197	-16.17
2	Arunachal Pradesh	135	180	33.33
3	Assam	376	325	-13.56
4	Bihar	157	137	-12.74
5	Goa	2	3	50.00
6	Gujarat	9	5	-44.44
7	Karnataka	257	305	18.68
8	Kerala	45	57	26.67
9	Madhya Pradesh	985	912	-7.41
10	Maharashtra	417	276	-33.81
11	Manipur	31	@	---
12	Meghalaya	34	53	55.88
13	Mizoram	18	28	55.56
14	Nagaland	104	83	-20.19
15	Orissa	243	226	-7.00
16	Rajasthan	99	64	-35.35
17	Sikkim	4	2	-50.00
18	Tamil Nadu	95	97	2.11
19	Uttar Pradesh	735	465	-36.73
20	West Bengal	353	335	-5.10
Total		4334	3750 *	-13.47 *

Source : Forestry Statistics India, 1995
@ : Census could not be concluded in 1993.
* : Does not include tiger population in Manipur.

CHART 6 : CHANGE OF TIGER POPULATION IN 1993 AS COMPARED TO 1989

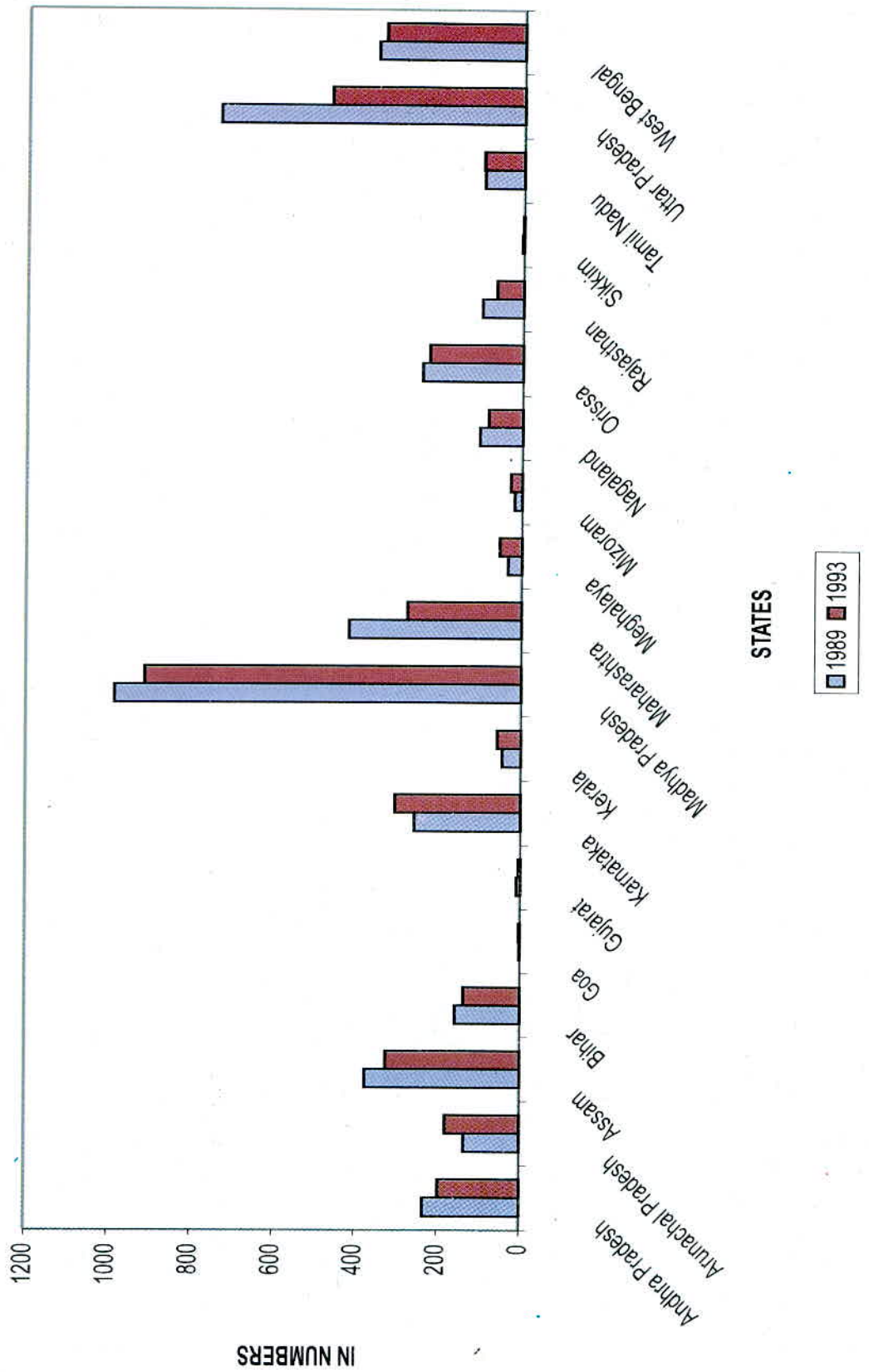


TABLE 3.3.7 : POPULATION OF TIGERS IN TIGER RESERVES

S. No.	Name of Tiger Reserve	State	Population of Tigers			
			1979	1984	1989	1993
1	Bandhavgarh	Rajasthan	NA	NA	NA	41
2	Bandipur	Karnataka	39	53	50	66
3	Buxa	West Bengal	NA	15	33	29
4	Corbett	Uttar Pradesh	84	90	91	123
5	Dampa	Mizoram	NA	NA	NA	7
6	Dudhwa	Uttar Pradesh	NA	80	90	94
7	Indravati	Madhya Pradesh	NA	38	28	18
8	Kalakad-Mundantharai	Tamilnadu	NA	20	22	17
9	Kanha	Madhya Pradesh	71	109	97	100
10	Manas	Assam	69	123	92	81
11	Melghat	Maharashtra	63	80	77	72
12	Nagarjunsagar	Madhya Pradesh	NA	65	94	44
13	Namdapha	Arunachal Pradesh	NA	43	47	47
14	Palamau	Bihar	37	62	55	44
15	Panna	Madhya Pradesh	NA	NA	NA	25
16	Pench	Madhya Pradesh	NA	NA	NA	39
17	Periyar	Kerala	34	44	45	30
18	Ranthambhore	Rajasthan	25	38	44	36
19	Sariska	Rajasthan	19	26	19	24
20	Simplipal	Orissa	65	71	93	95
21	Sunderbans	West Bengal	205	26	269	251
22	Tadoba-Andheri	Maharashtra	NA	NA	NA	34
23	Valmiki	Bihar	NA	NA	81	49
Total			711	983	1327	1366

Source: Forestry Statistics India, 1995

The tiger reserves are the specially constituted reserves representing different habitat types with the aim of maintenance of available tiger population in India in its natural environment. One of the main achievements of Project tiger launched in 1973 is the excellent recovery of habitat and increase in the population of all species of wildlife in the Reserves. Tiger population has increased from 711 in 1979 to 1366 in 1993.

TABLE 3.3.8: SEIZURES OF TIGER AND LEOPARD SKINS, BONES AND OTHER PARTS DURING 1980-94

Year	Species	Commodity	Quantity	Location(s)
1980	Tiger	Bone	Unknown	Near Dudwa (Uttar Pradesh)
1982	Leopard	Skin	1	Delhi
1984	Snow Leopard	Coat	1	Delhi
	Clouded Leopard	Skin	6	Delhi
	Leopard	Skin	2	Delhi
	Tiger	Skin	Unknown	Jammu & Kashmir
1985	Leopard	Skin	2	West Bengal
	Tiger	Skin	2	West Bengal, Delhi
1986	Leopard	Skin	5	West Bengal, Delhi
	Tiger	Skin	1	Delhi
1987	Leopard	Skin	4	Delhi
1988	Leopard	Skin	22	Delhi
1989	Tiger	Skin	9	Rajasthan,West Bengal
	Leopard	Skin	14	West Bengal, Delhi
	Tiger	Bone	Unknown	West Bengal
1990	Leopard	Skin	61	Delhi, Uttar Pradesh, Madhya Pradesh
	Tiger	Skin	5	Delhi
	Tiger	Bone	90 kg	Delhi
1991	Tiger	Skin	17	Delhi, Madhya Pradesh
	Leopard	Nails	5	West Bengal
	Leopard	Skin	6	Delhi
1992	Tiger	Skin	23 plus	Delhi, Madhya Pradesh, Rajasthan
	Tiger	Nails	300 pairs	Bombay
	Tiger	Bone	18 kg plus	MP,Raj
	Leopard	Skin	79 plus	Delhi, Madhya Pradesh
	Leopard	Bone	7.5 kg plus	Madhya Pradesh
	Leopard	Nails	18	Madhya Pradesh
	Leopard	Skull	1	Madhya Pradesh
	Clouded Leopard	Live	1	Assam
	Clouded Leopard	Skin	6 plus	Delhi
	Tiger	Jaw	1	Madhya Pradesh
1993	Tiger	Bone	667Kgs.	Delhi, Madhya Pradesh, Rajasthan
	Tiger	Skin	12	Delhi, Madhya Pradesh
	Leopard	Collorbone	1	Madhya Pradesh
	Leopard	Nails	54	Delhi
	Leopard	Skin	73	Delhi, Uttar Pradesh, Madhya Pradesh
1994 upto June	Tiger	Skin	5	Delhi, Uttar Pradesh, Madhya Pradesh
	Tiger	Bone	30 kgs	Madhya Pradesh
	Leopard	Skin	9	Delhi, Uttar Pradesh, Madhya Pradesh
	Leopard	Bone	40 kgs	Madhya Pradesh
	Leopard	Skull	1	Madhya Pradesh

Source : Forestry Statistics India 1995.

Wildlife Trade : Global Perspective

Wildlife trade is a big business. A tiger skin can fetch a price of over ten thousand dollars and whittled chunks of rhino horn sell at 450 dollars an ounce. Fur coats, made of belly fur of the lynx, are sold for 10000 dollars per coat. Ivory is sold at 80 dollars per kg.

SLENDER LORIS

TABLE 3.3.9 : INDIA'S LIVESTOCK POPULATION

(In thousand)

Livestock	Number of Animals			
	1977	1982	1987	1992
Cattle	180140	192453	199695	204516
Buffaloes	62019	69783	75966	84239
Sheep	40907	48765	45703	50781
Goats	75620	95255	110207	115281
Horses & Ponnies	916	900	797	817
Pigs	7647	10071	10625	12788
Mules	89	131	167	193
Donkeys	978	1024	958	966
Camels	1068	1078	1001	1031
Other Livestocks				
Yaks	132*	128*	36	59
Mithuns	129	154		
Total	**369526**	**419588**	**445284**	**470824**

* : Break-up Not Available

Source: Agriculture Statistics at a Glance, 1998
Department of Agriculture & Cooperation
Ministry of Agriculture

The livestock population in the country increased from 292 million in 1951 to the current estimate of 471 million. Grazing by Livestock put pressure on grasslands and forests. Because of excessive grazing, natural regeneration is either absent or inadequate in 52.8% of the forests in the country.

An analysis of forests vis-a-vis livestock indicates continued free access to the forest area which has resulted in high rates of growth of livestock population causing land degradation and arresting the development of markets for forage crops. Overgrazing impedes regeneration, retards growth of vegetation, and leads to extinction of good palatable grasses which are replaced by less palatable and inferior grasses. Extensive areas have been invaded by bushes which are not browsed, excessive trampling makes the soil compact and impervious and prevents circulation of air, water, thus exposing the soil to erosion by wind and water. Degradation of the forest and grazing lands may be attributed in a large measure to an increase in the goat population, which rose by 139% during the last 40 years.

CHART 7 : INDIA'S LIVESTOCK POPULATION

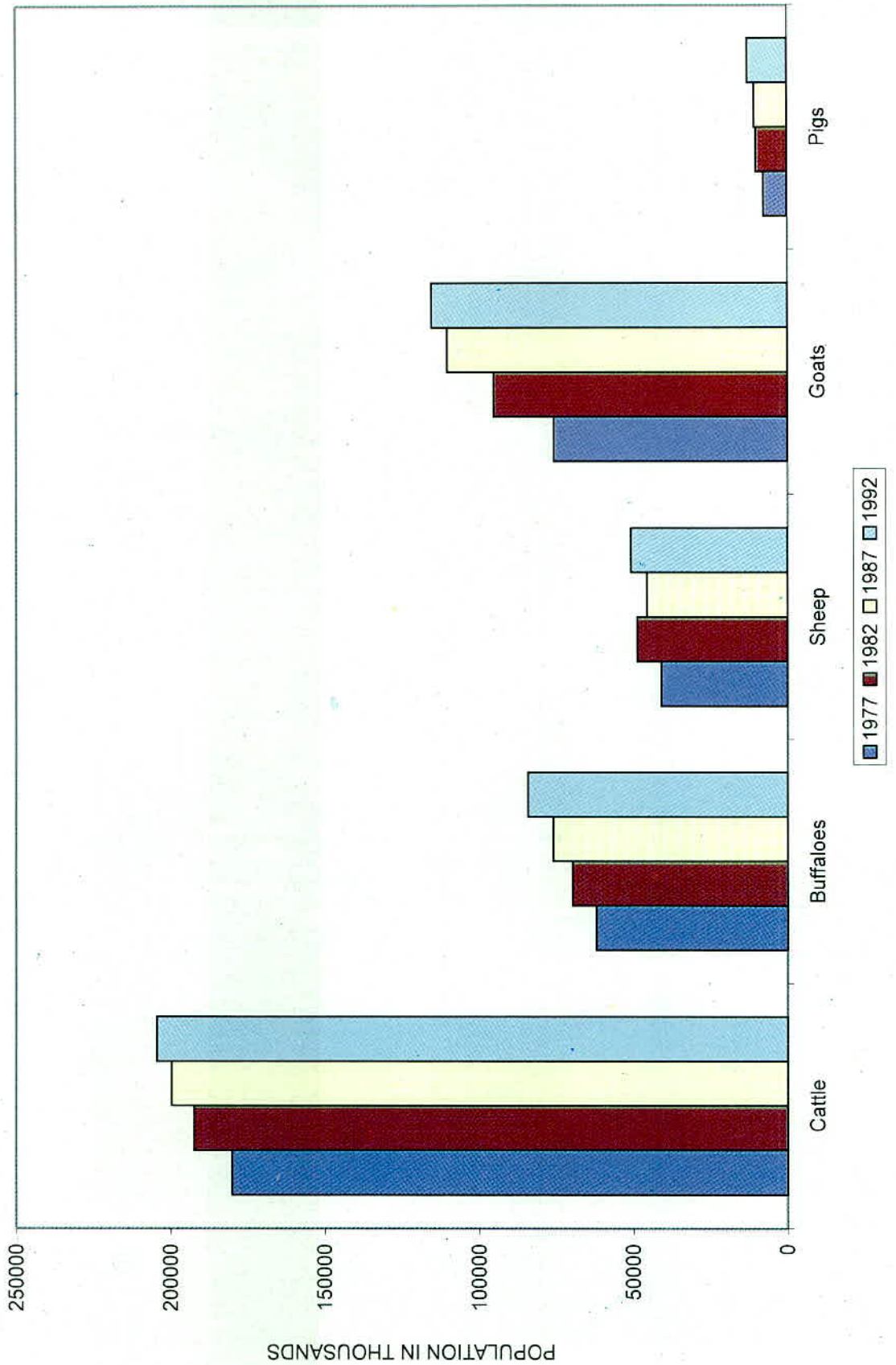


TABLE 3.3.10 : LIVESTOCK POPULATION AS PER 1992 CENSUS

(In thousand)

Srl.No.	State/Uts	Cattle			Buffalo
		Cross bred	Indigenous	Total	
1	Andhra Pradesh	486	10461	10947	9193
2	Arunachal Pradesh	22	305	327	9
3	Assam	243	7513	7756	958
4	Bihar	184	21963	22147	5353
5	Goa	8	92	100	45
6	Gujarat	231	6572	6803	5268
7	Haryana	416	1717	2133	4372
8	Himachal Pradesh	280	1885	2165	703
9	Jammu & Kashmir	793	2262	3055	732
10	Karnataka	627	12548	13175	4251
11	Kerala	1761	1768	3529	296
12	Madhya Pradesh	206	28481	28687	7970
13	Maharashtra	1774	15672	17446	5447
14	Manipur	69	648	717	115
15	Meghalaya	18	619	637	34
16	Mizoram	7	54	61	6
17	Nagaland	131	200	331	34
18	Orissa	744	14022	14766	1539
19	Punjab	1629	1282	2911	5238
20	Rajasthan	119	11513	11632	7743
21	Tamil Nadu	1835	7440	9275	2814
22	Tripura	107	818	925	20
23	Uttar Pradesh	2495	23136	25631	20086
24	West Bengal	962	16492	17454	1011
25	Sikkim	47	153	200	3
26	Andaman & Nicobar Islands	3	50	53	15
27	Chandigarh	6	1	7	6
28	Dadra & Nagar Haveli	1	49	50	4
29	Daman & Diu	0	7	7	1
30	Delhi	13	28	41	249
31	Lakshadweep	0	2	2	0
32	Pondicherry	59	34	93	7
Total		15276	187787	203063	83522

Table 3.3.10 continued....

TABLE 3.3.10 : LIVESTOCK POPULATION AS PER 1992 CENSUS

(In thousand)

Srl.No.	State/Uts	Yak	Mithun	Sheep		
				Crossbred	Indigenous	Total
1	Andhra Pradesh	0	0	44	7743	7787
2	Arunachal Pradesh	10	105	2	31	33
3	Assam	0	0	2	140	142
4	Bihar	0	0	43	1647	1690
5	Goa	0	0	0	0	0
6	Gujarat	0	0	14	2013	2027
7	Haryana	0	0	173	871	1044
8	Himachal Pradesh	6	0	73	1006	1079
9	Jammu & Kashmir	33	0	1196	1751	2947
10	Karnataka	0	0	150	5282	5432
11	Kerala	0	0	3	26	29
12	Madhya Pradesh	0	0	30	806	836
13	Maharashtra	0	0	34	3040	3074
14	Manipur	0	21	0	14	14
15	Meghalaya	0	0	0	0	0
16	Mizoram	1	1	1	0	1
17	Nagaland	0	26	1	2	3
18	Orissa	0	0	21	1756	1777
19	Punjab	0	0	133	393	526
20	Rajasthan	0	0	37	12460	12497
21	Tamil Nadu	0	0	264	5585	5849
22	Tripura	0	0	0	5	5
23	Uttar Pradesh	0	0	173	2231	2404
24	West Bengal	0	0	29	1459	1488
25	Sikkim	10	0	1	15	16
26	Andaman & Nicobar Islands	0	0	0	0	0
27	Chandigarh	0	0	1	0	1
28	Dadra & Nagar Haveli	0	0	0	0	0
29	Daman & Diu	0	0	0	0	0
30	Delhi	0	0	0	0	0
31	Lakshadweep	0	0	0	0	0
32	Pondicherry	0	0	1	3	4
Total		60	153	2426	48279	50705

Table 3.3.10 continued....

TABLE 3.3.10 : LIVESTOCK POPULATION AS PER 1992 CENSUS

(In thousand)

Srl.No.	State/Uts	Goats	Horses & Ponies	Mules	Donkeys	Camels
1	Andhra Pradesh	4329	7	0	40	0
2	Arunachal Pradesh	125	6	0	0	0
3	Assam	3454	19	0	0	0
4	Bihar	17461	117	4	29	0
5	Goa	15	0	0	0	0
6	Gujarat	4241	13	0	79	63
7	Haryana	799	50	26	74	128
8	Himachal Pradesh	1118	14	16	7	0
9	Jammu & Kashmir	1766	121	19	18	13
10	Karnataka	6285	13	0	33	0
11	Kerala	1849	0	0	0	13
12	Madhya Pradesh	8370	72	8	58	0
13	Maharashtra	9941	40	1	73	0
14	Manipur	39	1	0	0	0
15	Meghalaya	195	3	0	0	0
16	Mizoram	23	3	0	0	0
17	Nagaland	149	6	0	0	0
18	Orissa	4943	0	0	0	0
19	Punjab	544	40	16	36	43
20	Rajasthan	15308	25	4	201	750
21	Tamil Nadu	6343	9	0	43	0
22	Tripura	429	1	0	0	0
23	Uttar Pradesh	13110	249	102	277	35
24	West Bengal	14169	13	0	1	0
25	Sikkim	115	2	0	0	0
26	Andaman & Nicobar Islands	56	0	0	0	0
27	Chandigarh	2	1	0	0	0
28	Dadra & Nagar Haveli	19	0	0	0	0
29	Daman & Diu	4	0	0	0	0
30	Delhi	16	1	0	1	0
31	Lakshadweep	17	0	0	0	0
32	Pondicherry	44	0	0	0	0
Total		115278	826	196	970	1045

Table 3.3.10 continued....

TABLE 3.3.10 : LIVESTOCK POPULATION AS PER 1992 CENSUS

(In thousand)

Srl.No.	State/Uts	Pig			Total Poultry
		Cross-bred	Indigenous	Total	
1	Andhra Pradesh	73	575	648	49883
2	Arunachal Pradesh	9	230	239	1185
3	Assam	91	641	732	16393
4	Bihar	27	1098	1125	17654
5	Goa	1	89	90	731
6	Gujarat	1	102	103	5657
7	Haryana	194	323	517	8580
8	Himachal Pradesh	1	6	7	723
9	Jammu & Kashmir	1	11	12	4630
10	Karnataka	39	341	380	16161
11	Kerala	14	121	135	21905
12	Madhya Pradesh	15	704	719	11800
13	Maharashtra	28	347	375	32187
14	Manipur	133	250	383	3260
15	Meghalaya	102	192	294	1826
16	Mizoram	73	39	112	1086
17	Nagaland	244	282	526	2165
18	Orissa	12	560	572	13063
19	Punjab	35	65	100	18331
20	Rajasthan	15	238	253	3055
21	Tamil Nadu	12	661	673	24555
22	Tripura	12	176	188	2596
23	Uttar Pradesh	419	2486	2905	10790
24	West Bengal	86	868	954	37408
25	Sikkim	9	36	45	302
26	Andaman & Nicobar Islands	2	35	37	614
27	Chandigarh	1	3	4	181
28	Dadra & Nagar Haveli	0	0	0	117
29	Daman & Diu	0	0	0	26
30	Delhi	5	7	12	61
31	Lakshadweep	0	0	0	123
32	Pondicherry	0	1	1	27
Total		1654	10487	12141	307075

Source : Annual Report 1996-97, Department of Animal Husbandry & Diary Development, Ministry of Agriculture.

TABLE 3.3.11 : FISH PRODUCTION

(in lakh tonnes)

Year	Marine	Inland	Total
1950-51	5.34	2.18	7.52
1960-61	8.80	2.80	11.60
1970-71	10.86	6.70	17.56
1973-74	12.10	7.48	19.58
1980-81	15.55	8.87	24.42
1981-82	14.45	9.99	24.44
1982-83	14.27	9.40	23.67
1983-84	15.19	9.87	25.06
1984-85	16.98	11.03	28.01
1985-86	17.16	11.60	28.76
1986-87	17.13	12.29	29.42
1987-88	16.58	13.01	29.59
1988-89	18.17	13.35	31.52
1989-90	22.75	14.02	36.77
1990-91	23.00	15.36	38.36
1991-92	24.47	17.10	41.57
1992-93	25.76	17.89	43.65
1993-94	26.49	19.95	46.44
1994-95	26.92	20.94	47.86
1995-96	27.07	22.42	49.49
1996-97	29.67	23.81	53.48

Source : Agriculture Statistics at a Glance, 1998
Department of Agriculture & Cooperation
Ministry of Agriculture

TABLE 3.3.12 : STATE-WISE FISH PRODUCTION

(In Tonnes)

States/UT's	Marine	Inland	Total
Andhra Pradesh	152047	207312	359359
Arunachal Pradesh	0	1852	1852 *
Assam	0	154611	154611
Bihar	0	249780	249780
Goa	93760	3304	97064
Gujarat	660068	65278	725346
Haryana	0	30000	30000
Himachal Pradesh	0	6265	6265
Jammu & Kashmir	0	17800	17800
Karnataka	222779	101654	324433
Kerala	578925	52105	631030
Madhya Pradesh	0	110532	110532
Maharashtra	481000	109000	590000
Manipur	0	12705	12705
Meghalaya	0	3578	3578
Mizoram	0	2550	2550
Nagaland	0	4000	4000
Orissa	133462	143496	276958
Punjab	0	32000	32000
Rajasthan	0	14300	14300
Sikkim	0	150	150
Tamil Nadu	350790	109000	459790
Tripura	0	27473	27473
Uttar Pradesh	0	149425	149425
West Bengal	172000	765000	937000
A & N Islands	26403	38	26441
Chandigarh	0	82	82 *
Dadar & Nagar Haveli	0	40	40
Daman & Diu	15283	0	15283
Delhi	0	4000	4000 *
Lakshadweep	11750	0	11750
Pondicherry	38544	4100	42644
Deep Sea Fishing Sector	30000	0	30000
Total	**2966811**	**2381430**	**5348241**

Source : Agriculture Statistics at a Glance, 1998
Department of Agriculture & Cooperation
Ministry of Agriculture

* : Figures relate to year 1995-96.

TABLE 3.3.13 : INLAND FISHERY WATER RESOURCES OF INDIA, 1995

S. N o.	State/Uts.	Length Of Rivers & Canals (Kms)	Area Of Reservoirs (Lakh Sq. Kms.)	Area Under Tanks & Ponds (Lakh Sq. Kms.)	Beels Oxbow & Derelict Water (Lakh Sq. Kms.)	Brackish Water (Lakh Sq. Kms.)
1	Andhra Pradesh	11514	0.0234	0.0517	Nil	0.0064
2	Assam	4820	0.0002	0.0023	0.0110	Nil
3	Bihar	3200	0.0060	0.0095	0.0005	Nil
4	Goa	250	0.0003	0.0003	Nil	Nil
5	Gujarat	3865	0.0243	0.0071	0.0012	0.0376
6	Haryana	5000	Neg.	0.0010	0.0010	Nil
7	Himachal Pradesh	3000	0.0042	0.0001	Nil	Nil
8	Jammu & Kashmir	27781	0.0007	0.0017	0.0006	Nil
9	Karnataka	9000	0.0220	0.0414	Nil	0.0008
10	Kerala	3092	0.0030	0.0030	0.0243	0.0243
11	Madhya Pradesh	20661	0.0294	0.0119	Nil	Nil
12	Maharashtra	1600	0.0279	0.0050	Nil	0.0010
13	Manipur	3360	0.0001	0.0005	0.0040	Nil
14	Meghalya	5600	0.0008	0.0002	Neg.	Nil
15	Nagaland	1600	0.0017	0.0050	Neg.	Nil
16	Orissa	4500	0.0256	0.0114	0.0180	0.0417
17	Punjab	15270	Neg.	0.0007	Nil	Nil
18	Rajasthan	NA	0.0120	0.0180	Nil	Nil
19	Sikkim	900	Nil	Nil	0.0003	Nil
20	Tamilnadu	7420	0.0052	0.0691	NA	0.0056
21	Tripura	1200	0.0005	0.0012	Nil	Nil
22	Uttar Pradesh	31200	0.0150	0.0162	0.0133	Nil
23	West Bengal	2526	0.0017	0.0276	0.0042	0.0210
24	Arunanchal pradesh	2000	Nil	0.0276	0.0042	0.0210
25	Mizoram	1395	Nil	0.0002	Nil	Nil
26	Andaman & Nicobar	115	0.0001	0.0003	Nil	0.0037
27	Chandigarh	2	Nil	Neg.	Neg.	Nil
28	Delhi	150	0.0004	Nil	Nil	Nil
29	Lakshadweep	Nil	Nil	Nil	Nil	Nil
30	Pondicherry	247	Nil	Neg.	0.0001	0.0001
31	Dadra & Nagar Haweli	54	0.0005	Nil	Nil	Nil
32	Daman & Diu	12	Nil	Nil	Nil	Nil
	Total	171334	0.2050	0.3130	0.0827	0.1632

Source : Hand book on Fisheries Statistics 1996, Department of Agriculture and Cooperation

TABLE 3.3.14 : MARINE FISHERY RESOURCES OF INDIA

S. No.	States/UT's.	Continental Shelf (Thousand Sq. Kms.)	Number of Landing Centres	Number of Villages	Approx. Length of Coast line (Kms.)
1	Andhra Pradesh	31	379	409	974
2	Goa	10	87	91	104
3	Gujarat	164	854	851	1600
4	Karnataka	27	28	204	300
5	Kerala	40	226	222	590
6	Maharashtra	112	184	395	720
7	Orissa	24	63	329	480
8	Tamilnadu	41	362	442	1000
9	West Bengal	17	47	652	157
10	Andaman & Nicobar	35	57	45	1912
11	Pondicherry	1	28	45	45
12	Lakshadweep	4	11	10	132
13	Daman & Diu	0	7	31	27
Total		506	2333	3726	8041

Source : Hand book on Fisheries Statistics 1996, Department of Agriculture and Cooperation

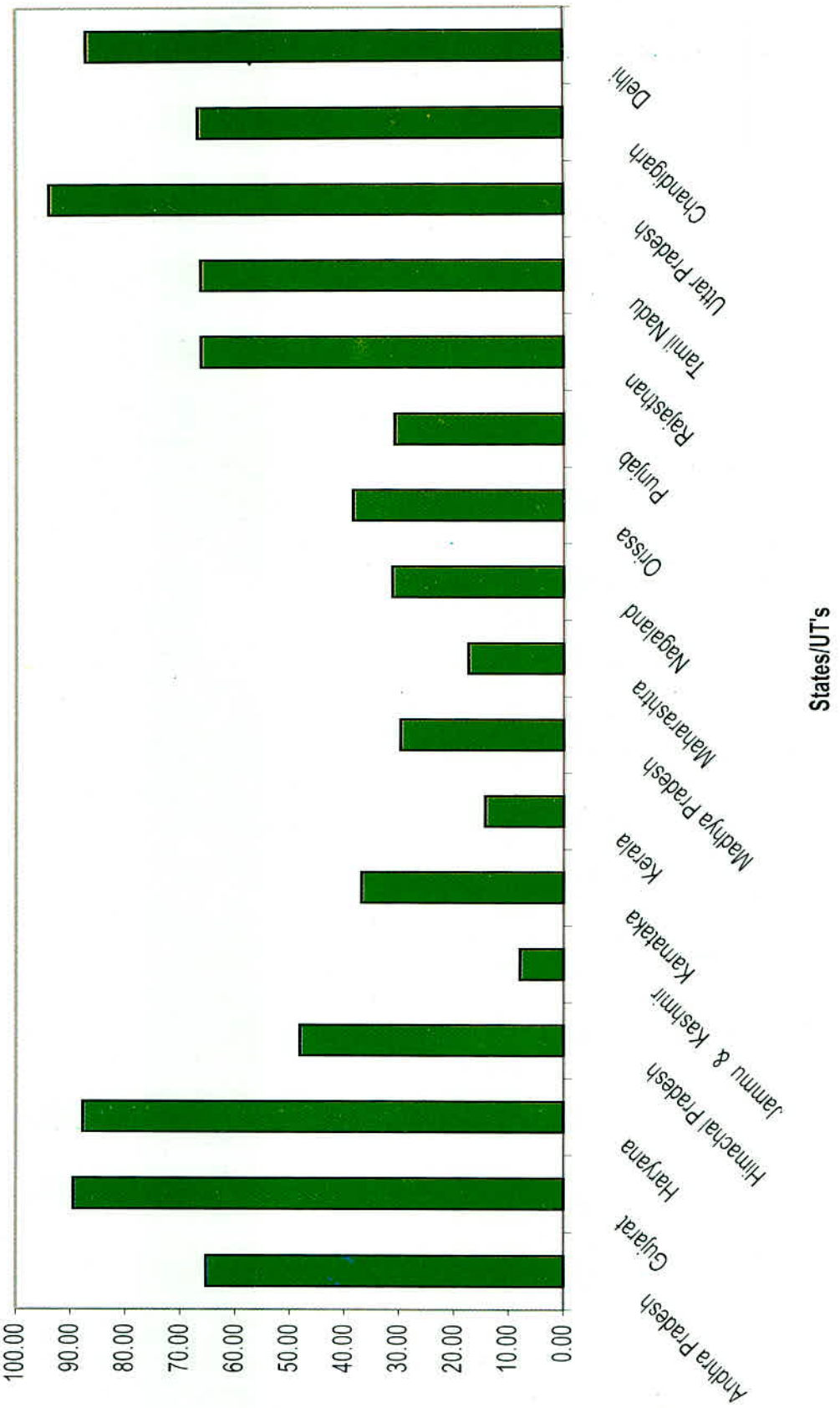
TABLE 3.3.15 : BOVINE POPULATION AFFECTED BY DROUGHT, 1987

S.No	State/Union Territory	Total Bovine Population (lakhs)	Bovine Population Affected (lakhs)
1	Andhra Pradesh	219.0	143.0
2	Gujarat	114.0	102.0
3	Haryana	57.0	50.0
4	Himachal Pradesh	58.0	27.9
5	Jammu & Kashmir	29.0	2.3
6	Karnataka	149.0	55.0 *
7	Kerala	35.0	5.0
8	Madhya Pradesh	336.0	100.0
9	Maharashtra	201.0	35.0 *
10	Nagaland	1.6	0.5
11	Orissa	143.0	55.0 *
12	Punjab	78.0	24.0
13	Rajasthan	195.0	129.0
14	Tamil Nadu	136.0	90.0
15	Uttar Pradesh	419.0	393.0
16	Chandigarh	0.3	0.2
17	Delhi	2.3	2.0
	Total	2143.2	1203.7

Source: The Drought of 1987 Response and Managment
Ministry of Agriculture,1989

* Estimated

CHART 8 : Percentage of Bovine Population affected by Drought, 1987



CHAPTER FOUR

ATMOSPHERE

4.1 AMBIENT AIR POLLUTION

The main sources of air pollution in India are automobiles, thermal power plants, industries, agriculture, quarrying etc. The reasons are growing industrialisation, without any priority for pollution abatement, and rising number of motor vehicles. The growth of the number of motor vehicles in the last three decades in India has been almost 32 times. To overcome the growing problems of air pollution, India has established ambient air quality standards, under section 16(2)(h) of the Air (Prevention and Control of Pollution) Act, 1981. Till early 1994, ambient air quality standards in India were based on eight-hourly averaging time only. In April 1994, these standards were revised and 24-hourly standards were also prescribed. These National Ambient Air Quality standards are prescribed for three distinct areas, viz. i) Industrial ii) residential, rural and other areas, and iii) sensitive areas.

4.2 GREENHOUSE GASES AND THEIR EFFECT

The greenhouse effect plays a crucial role in regulating the heat balance of the earth. It allows the incoming short-wave solar radiation to pass through the atmosphere relatively unimpeded; but the long-wave terrestrial radiation emitted by the earth's surface is partially absorbed and then re-emitted by a number of trace gases in the atmosphere. These gases known as GHGs (greenhouse gases) are: water vapour, carbon dioxide, methane, nitrous oxide and ozone in the troposphere and in the stratosphere. This natural greenhouse effect warms the lower atmosphere.

If the atmosphere were transparent to the outgoing long-wave radiation emanating from the earth's surface, the equilibrium mean temperature of the earth's surface would be considerably lower and probably below the freezing point of water. Mere incidence of GHG's in the atmosphere, by itself, is no concern. What is more important is that their concentrations should stay within reasonable limits so that global ecosystem is not unduly affected. However, by increasing the concentrations of natural GHG's and by adding new GHG's like chloroflourocarbons the global average, and the annual mean surface-air temperature (referred to as the global temperature) can be raised, although the rate at which it will occur is uncertain. This is the enhanced greenhouse effect, which is over and above that occurring due to natural greenhouse concentrations. Such a rise in the atmospheric concentration of GHG's has led to an upward trend in global temperature.

4.3 ENVIRONMENT POLLUTION DUE TO ENERGY USE

The environmental effects of various fuels, namely, coal, oil; nuclear, etc. are of growing concern owing to increasing consumption levels. The combustion of these fuels in industries and vehicles has been a major source of pollution. Coal production through opencast mining; its supply to and consumption in power stations; and industrial boilers leads to particulate and gaseous pollution which can cause pneumoconiosis, bronchitis, and respiratory diseases. Another major impact of coal mining is land degradation, especially of forest areas.

The consumption of petroleum products in vehicles, industries and domestic cooking activities results in the emission of pollutants in large quantities. Radioactive emissions from nuclear power plants are of grave concern as they can cause serious impact both in terms of spatial and inter-generational concerns. In addition, two key problems are long-term waste disposal and the eventual decommissioning of plants.

4.4 INDUSTRIAL EMISSIONS

Air-borne emissions emitted from various industries are a cause of major concern. These emissions are of two forms, viz. solid particles (SPM) and gaseous emissions (SO_2, NO_X, CO, etc.). Liquid effluents, generated from certain industries, containing organic and toxic pollutants are also a cause of concern. Heavily polluting industries were identified which are included under the 17 categories of highly polluting industries for the purpose of monitoring and regulating pollution from them. The Ministry of Environment and Forests has, over the last two decades, developed standards for regulating emissions from various industries and emission standards for all the polluting industries including thermal power stations, iron and steel plants, cement plants, fertilizer plants, oil refineries, pulp and paper, petrochemicals, sugar, distilleries and tanneries have been prescribed. Most of the air-borne emission standards include permissible limits for particulate matter (SPM) and in a few cases SO_2, where it is the prime pollutant, while no standards for NO_X and CO were specified.

4.5 VEHICULAR EMISSIONS

Vehicular emission standards were set in 1986 by CPCB for both petrol and diesel driven vehicles. These were later revised in 1987 and 1989. The prevailing standards for petrol-driven vehicles specify limits for CO for two and three wheeler (3%) and four wheelers (4.5%) respectively. The standard for diesel-driven vehicles specifies limits for smoke as 65 Hartridge units.

4.6 NOISE POLLUTION

Of late, noise has been recognised as a pollutant which, until recently was considered only as a nuisance. The Central Pollution Control Board (CPCB) has notified the ambient noise standards in 1987 under section 20 of the air (Prevention and Control of Pollution) Act, 1981. The noise standards specify limits as 55 dB (A) and 45 dB (A) as limits for day and night time respectively for residential areas, 75 dB (A) and 70 dB (a) in the day and night time for industrial areas, and 50 dB (A) and 40 dB (A) in the day and night time for silence zones.

TABLE 4.1.1 : AVERAGE GASEOUS COMPOSITION OF DRY AIR IN THE TROPOSPHERE

Gas	Percent by volume	Parts per million(ppm)
Nitrogen	78.080000	780840.00
Oxygen	20.950000	209500.00
Argon	0.930000	9300.00
Carbon dioxide	0.034500	345.00
Neon	0.001800	18.00
Helium	0.000520	5.20
Methane	0.000140	1.40
Kryton	0.000100	1.00
Hydrogen	0.000050	0.50
Xenon	0.000009	0.09
Ozone	Variable	Variable

Source : State of the Environment 1995,
Ministry of Environment and Forests.

TABLE 4.1.2 : NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant	Sulpher Dioxide (SO_2)		Oxides of Nitrogen (NO_2)		Suspended Particulate Matter (SPM)	
Time Weighted Average	Annual * Average (ug/m^3)	24 hours** Average (ug/m^3)	Annual * Average (ug/m^3)	24 hours** Average (ug/m^3)	Annual * Average (ug/m^3)	24 hours** Average (ug/m^3)
Industrial Area	80	120	80	120	360	500
Residential,Rural and Other Area	60	80	60	80	140	200
Sensitive Area	15	30	15	30	70	100
Methods of Measurement	Improved West and Gaeke methods	Ultravoilet fluoresce--nce	Jacab and Hocheiser modified (Na-Arsenite) method	Gas phase Chemilumini scence	High volume sampling (Average flow rate not less than 1.1 m3/minute)	

Source : Ambient Air Quality-Status & Statistics, 1995 Central Pollution Control Board

* : Annual Arithmatic Mean of minimum 104 measurements in a year taken twice a week 24-hourly at uniform interval.

** : 24-hourly /8 -hourly values should be met 98% of the time in a year. However 2% of the time, it may exceed but not on two consecutive days.

Note : 1. National Ambient Air Quality Standards : The level of air quality necessary with an adequate margin of safety, to protect the public health, vegetation and property.

2. Whenever and wherever two consecutive values exceed the limits specified above for the respective category, it would be considered adequate reason to institute regular/continuous monitoring and further investigations.

3. The State Govt. / State Boards shall notify the sensitive and other areas in the respective states.

The primary aim of the ambient air quality standards is to provide a basis for protecting public health from adverse effects of air pollution and for eliminating or reducing to a minimum, those contaminants of air that are known or likely to be hazardous to human being, animals vegetation and historical monuments.

TABLE 4.1.3 : STATE OF AMBIENT AIR QUALITY IN 10 MAJOR CITIES OF INDIA DURING 1991

City	SO_2	NO_2	NH_3	H_2S	SPM	RS PM
Ahmedabad	16	7	17	1	285	122
Mumbai	27	26	51	2	226	91
Calcutta	62	39	93	4	394	180
Delhi	33	46	176	1	543	204
Hydrabad	10	19	10	2	156	56
Jaipur	8	14	29	2	338	108
Cochin	11	10	74	1	115	58
Kanpur	7	13	65	1	380	135
Chennai	8	13	33	2	101	67
Nagpur	9	9	70	1	173	82

Source: State of The Environment 1995, India, Ministry of Environment and Forests

Units are in 10^{-6} grammes per cubic metre

TABLE 4.1.4 : AMBIENT AIR QUALITY STATUS IN SOME CITIES/TOWNS DURING 1995

Pollution Level	Annual Mean Concentration Range (microgram per cubic meter)			
	Industrial		Residential	
	SO_2 & NO_2	SPM	SO_2 & NO_2	SPM
Low (L)	0-40	0-180	0-30	0-70
Moderate (M)	40-80	180-360	30-60	70-140
High (H)	80-120	360-540	60-90	140-210
Critical (C)	>120	>540	>90	>210

State/City	Sulphur Dioxide		Nitrogen Dioxide		SPM	
Area class	I*	R**	I*	R**	I*	R**
Andhra Pradesh						
Hyderabad	L	L		M	M	
Vishakhapatnam	L	L	L	M	L	H
Assam						
Guwahati		L		M		M
Bihar						
Dhanbad		M		M		C
Jharia	M		M		H	
Patna		L		L		C
Sindri	L		M		M	
Delhi	L	M	M	C	H	C
Gujarat						
Ahmedabad	L	H	L	L	M	C
Ankleshwar	H	H	L	L	M	C
Rajkot	L	L	L	L	C	C
Vapi		M		M		H
Baroda	M	H	L	L	M	C
Surat	H	C	L	M	M	C
Goa						
Vasco	L		L		L	
Ponda		L		L		H
Himachal Pradesh						
Shimla		L		L		H
Damtal				L		C
Parwanoo			L	L	M	C
Paonta Sahib			L		M	
Haryana						
Faridabad	L	M	L	L	M	C
Yamuna Nagar	L		L			
Kerala						
Cochin	L	L	L	L	L	M
Kottayam	L	L	M	L	L	H
Kozhikode		L		L		M
Trivendrum		L		L		H

Table 4.1.4 continued...

TABLE 4.1.4 : AMBIENT AIR QUALITY STATUS IN SOME CITIES/TOWNS DURING 1995

State/City	Sulphur Dioxide		Nitrogen Dioxide		SPM	
Areaclass	I*	R**	I*	R**	I*	R**
Maharashtra						
Mumbai	M	L	L	M		
Dombivali	L		L		M	
Nagpur	L	L	L	L	M	C
Pune	L	L	L	L	M	M
Madhya Pradesh						
Bhilai	L	L	L	M	H	C
Bhopal	L	L	L	L	M	C
Indore	L	L	L	L	H	C
Jabalpur		L		H		H
Korba						C
Nagda	M	M	L	M	L	C
Satna	L	L	L	L	M	C
Raipur	L	L	L	L	M	C
Orissa						
Rourkela		L	L	L	M	H
Talcher					L	
Rajasthan						
Alwar	L	L	M	H	H	C
Jaipur	L	L	L	M	M	C
Kota	L	L	M	H	M	H
Jodhapur	M	M	L	M	H	C
Udaipur		L		M		C
Tamil Nadu						
Chennai	L	L	L	L	M	
Coimbatore		L		L		L
Tuticorin		L		L		L
Uttar Pradesh						
Anpara	M		M		M	
Dehradoon	L	L	L	L		
Kanpur	L	L	L	L		C
Luknow	L	M	L	L	H	C
West Bengal						
Calcutta	M	M	L	M	H	C
Haldia	L		M		L	
Howrah	L	C	C	C	M	C
Pondichery	H	M	H	H	M	H

Source : Ambient Air Quality-Status & Statistics, 1995 Central Pollution Control Board

I* : Industrial

R** : Residential

TABLE 4.2.1 : INSTALLED CAPACITIES OF UTILITIES, 1996

State/Union Territory	Hydro	Steam	Diesel and wind	Gas	Nuclear
Northern Region					
Haryana	883.90	892.50	3.92	0.00	0.00
Himachal Pradesh	288.87	0.00	0.13	0.00	0.00
Jammu & Kashmir	184.06	0.00	6.76	175.00	0.00
Punjab	1798.94	1710.00	0.00	0.00	0.00
Rajasthan	971.08	975.00	0.00	38.50	0.00
Uttar Pradesh	1504.75	4564.00	0.00	0.00	0.00
Chandigarh	0.00	0.00	2.00	0.00	0.00
Delhi	0.00	371.60	0.00	282.00	0.00
Central sector	1530.00	4980.00	0.00	1882.00	895.00
Subtotal	**7161.60**	**13493.10**	**12.81**	**2377.50**	**895.00**
Western region					
Gujarat	487.00	4179.00	35.58 @	627.00	0.00
Madhya Pradesh	846.11	3017.50	0.00	0.00	0.00
Maharashtra	1780.22	7155.00	0.00	1092.00	0.00
Goa	0.05	0.00	0.11 *	0.00	0.00
Dadra & Nagar Haveli	0.00	0.00	0.00	0.00	0.00
Daman & Diu	0.00	0.00	0.00	0.00	0.00
Central sector	0.00	3360.00	0.00	1292.00	860.00
Subtotal	**3113.38**	**17711.50**	**35.69**	**3011.00**	**860.00**
Southern region					
Andhra Pradesh	2656.94	2452.50	2.00 *	99.00	0.00
Karnataka	2409.55	840.00	129.92 $	0.00	0.00
Kerala	1491.50	0.00	0.00	0.00	0.00
Tamil Nadu	1947.70	2970.00	19.35 *	130.00	0.00
Lakshadweep	0.00	0.00	6.92	0.00	0.00
Pondicherry	0.00	0.00	0.00	0.00	0.00
Central sector	0.00	4170.00	0.00	0.00	470.00
Subtotal	**8505.69**	**10432.50**	**158.19**	**229.00**	**470.00**
Eastern region					
Bihar	164.90	1603.50	0.00	0.00	0.00
Orissa	1271.92	420.00	0.00	0.00	0.00
West Bengal	96.51	3356.38	22.50	100.00	0.00
Damodar Valley Corporation	144.00	2217.50	0.00	90.00	0.00
Andaman & Nicobar Islands	0.00	0.00	28.33	0.00	0.00
Sikkim	32.89	0.00	2.70	0.00	0.00
Central sector	0.00	3910.00	0.00	0.00	0.00
Subtotal	**1710.22**	**11507.38**	**53.53**	**190.00**	**0.00**
North-eastern region					
Assam	2.00	330.00	20.69	244.50	0.00
Manipur	2.60	0.00	9.41	0.00	0.00
Meghalaya	186.71	5.00	2.05	0.00	0.00
Nagaland	3.50	0.00	2.00	0.00	0.00
Tripura	16.01	0.00	4.85	48.50	0.00
Arunachal Pradesh	23.55	0.00	15.88	0.00	0.00
Mizoram	5.31	0.00	20.36	0.00	0.00
Central sector	255.01	0.00	0.00	167.50	0.00
Subtotal	**494.69**	**335.00**	**75.24**	**460.50**	**0.00**
All-India	**20985.58**	**53479.48**	**335.46**	**6268.00**	**2225.00**

Notes :
* : Wind Mill Generating Cap.
@ : Includes 18.10 MW of Wind mill
$: Includes 2.00 MW of wind mill Generating Capacity

Source : General Review, 1995-96, Central Electricity Authority

TABLE 4.2.2 : GENERATING CAPACITY AND ELECTRICITY GENERATION

Parameter	1980-81	1990-91	1991-92	1992-93	1993-94	1994-95
Generating capacity*						
All-India Utilities	**33316**	**74699**	**78367**	**82375**	**87475**	**92258**
Total	30214	66086	69065	72330	76753	81164
Public sector	28832	63344	66149	69426	73729	77618
Private sector	1382	2742	2916	2904	3024	3546
Average annual growth rate (per cent) during the decade	7.46	8.14	7.88	7.42	6.91	6.60
Non-utilities(including railways)						
Hydro	3	4	4	4	4	4
Steam	2137	5010	5396	5560	5812	6080
Gas	54	475	496	631	774	775
Diesel and wind	908	3124	3406	3850	4132	4235
Total (non-utilities)	**3102**	**8613**	**9302**	**10045**	**10722**	**11094**
Electricity Generation**						
All-India Utilities	**119260**	**289439**	**315631**	**332713**	**356335**	**384139**
Total	110844	264329	287029	301362	324050	350639
Public sector	104114	251382	273312	287536	310197	335521
Private sector	6730	12947	13717	13826	13853	15118
Average annual growth rate (per cent) during the decade	7.10	9.08	9.08	8.75	8.74	8.38
Non-utilities(including railways)						
Hydro	15	15	17	16	15	15
Steam	7232	20017	23413	24682	25416	26507
Gas	102	1845	1905	2803	3149	3150
Diesel and wind	1067	3233	3267	3850	3705	3828
Total (non-utilities)	**8416**	**25110**	**28602**	**31351**	**32285**	**33500**

Source : CEA. 1996. Power Supply Industry in India, Highlights.

* : in megawatts

** : in gigawatts-hours

TABLE 4.2.3 : CONSUMPTION OF FOSSIL FUELS FOR ELECTRICITY GENERATION FROM THERMAL STATIONS (BY KIND OF FUELS) REGIONWISE/STATEWISE DURING 1995-96

State/Union Territory	Steam Stations									Gas Stations		Diesel Stations		
	Coal (MT)	Lignite (MT)	Furnace Oil (KL)	Light Diesel Oil/HSD (KL)	LSHS/HHS* (KL)	Natural Gas (M. Cu. Mts.)	Heat Input (K.Cal.x 1000,000,000)	Gross Generation (GWH)	Average Heat Input (K.Cal./Kwh)	Natural Gas (Million Cu. Mts.)	Generation (GWH)	Diesel Oil (K Lts.)	Generation (GWH)	Average Oil Consumed (Lts/Kwh)
Northern Region														
Haryana	2507914	0	21837	3082	29000	0.00	10861.85	3342.00	3250	0.00	0.00	0.00	0.00	0.00
Himachal Pradesh	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Jammu & Kashmir	0	0	0	0	0	0.00	0.00	0.00	0	19885.27	63.00	0.00	0.00	0.00
Punjab	5824080	0	3308	3200	28634	0.00	22791.88	8232.05	2769	0.00	0.00	0.00	0.00	0.00
Rajasthan	3214235	0	17438	2706	6190	0.00	16733.51	5935.09	2819	12.58	16.33	0.00	0.00	0.00
Uttar Pradesh	13959825	0	52772	36039	0	0.00	46117.34	17813.33	2589	0.00	0.00	0.00	0.00	0.00
Chandigarh	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Delhi	1424874	0	27127	2606	0	0.00	4579.50	1592.93	2875	7916.89	625.69	0.00	0.00	0.00
Central sector	20540172	0	39818	3983	4325	0.00	86489.22	34175.76	2531	6391.54	9966.62	0.00	0.00	0.00
Subtotal	**47471100**	**0**	**162300**	**51616**	**68149**	**0.00**	**187573.30**	**71091.16**	**2638**	**34206.28**	**10671.64**	**0.00**	**0.00**	**0.00**
Western region														
Gujarat	12481108	707450	45788	7386	841540	198.00	64073.35	23588.14	2716	663.85	1654.82	0.00	0.00	0.00
Madhya Pradesh	12976057	0	92305	27263	4642	0.00	46572.66	15345.73	3032	0.00	0.00	0.00	0.00	0.00
Maharashtra	25243214	0	103917	16037	1120338	623611.00	110275.65	39794.36	2771	2074.14	6343.21	0.00	0.00	0.00
Goa	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Daman & Diu	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Dadra & Nagar Haveli	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Central sector	15935756	0	14492	399	0	0.00	60147.46	24669.21	2438	956.95	4333.65	0.00	0.00	0.00
Subtotal	**66636135**	**707450**	**256502**	**51085**	**1966520**	**623809.00**	**281069.12**	**103397.44**	**2718**	**3694.94**	**12331.68**	**0.00**	**0.00**	**0.00**
Southern region														
Andhra Pradesh	12475227	0	41060	4218	991	0.00	40889.28	15102.86	2707	144.59	540.33	0.00	0.00	0.00
Karnataka	3335427	0	7815	173	0	0.00	11072.00	4721.83	2345	0.00	0.00	162631.92	543.00	0.30
Kerala	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Tamil Nadu	11252133	0	16023	1712	1758	0.00	45603.88	17219.66	2648	5.67	17.91	0.00	0.00	0.00
Lakshadweep	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Pondicherry	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	4164.50	15.41	0.27
Central sector	9356401	14474388	22479	2827	17901	0.00	72300.24	27009.91	2676	0.00	0.00	0.00	0.00	0.00
Subtotal	**36419188**	**14474388**	**87377**	**8930**	**20650**	**0.00**	**169865.40**	**64054.26**	**2652**	**150.26**	**558.24**	**166796**	**558**	**0.30**
Eastern region														
Bihar	1940043	0	13741	45813	11638	0.00	8054.86	2007.14	4013	0.00	0.00	0.00	0.00	0.00
Orissa	1116485	0	21072	0	0	0.00	5065.32	1374.00	4681	0.00	0.00	0.00	0.00	0.00
West Bengal	9582506	0	0	56400	0	0.00	45526.33	14116.87	3224	23228.36	37.70	0.00	0.00	0.00
Damodar Valley Corporat	4775172	0	91946	0	0	0.00	22161.82	6402.92	3461	92467.33	42.09	0.00	0.00	0.00
Andaman & Nicobar Islan	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	23613.86	83.87	0.28
Sikkim	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	171.49	0.74	0.23
Central sector	5934223	0	46805	0	0	0.00	27699.02	10605.68	2612	0.00	0.00	0.00	0.00	0.00
Subtotal	**23348429**	**0**	**173564**	**102213**	**11638**	**0.00**	**108507.35**	**34506.61**	**3145**	**115695.69**	**79.79**	**23785.35**	**84.61**	**0.28**
North-eastern region														
Assam	340799	0	59050	3787	52874	0.00	2870.49	693.93	4136	406.63	728.77	0.00	0.00	0.00
Manipur	0	0		0	0	0.00	0.00	0.00	0	0.00	0.00	1560.11	3.70	0.42
Meghalaya	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Nagaland	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	189.74	0.45	0.42
Tripura	0	0	0	0	0	0.00	0.00	0.00	0	145.65	152.24	733.68	1.96	0.37
Arunachal Pradesh	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	5121.19	16.90	0.30
Mizoram	0	0	0	0	0	0.00	0.00	0.00	0	0.00	0.00	3734.27	13.07	0.29
Central sector	0	0	0	0	0	0.00	0.00	0.00	0	321.47	336.02	0.00	0.00	0.00
Subtotal	**340799**	**0**	**59050**	**3787**	**52874**	**0.00**	**2870.49**	**693.93**	**4137**	**873.75**	**1217.03**	**11338.99**	**36.08**	**0.31**
All-India	**174215651**	**15181838**	**738793**	**217631**	**2119831**	**623809.00**	**749885.66**	**273743.40**	**2739**	**154620.92**	**24858.38**	**201920.76**	**679.10**	**0.30**

Source General Review, 1995-96, Central Electricity Authority

TABLE 4.2.4 : ANNUAL GROSS GENERATION OF POWER BY SOURCE

(in MW units)

Year	Hydro	Steam	Diesel & Wind	Gas	Nuclear	Total
1980-81	46541.8	60713.8	61.5	522.0	3001.3	110840.4
1985-86	51020.6	112540.1	50.6	1756.9	4981.9	170350.1
1990-91	71641.3	178321.7	111.3	8113.2	6141.1	264328.6
1991-92	72757.1	197163.2	134.0	11450.0	5524.4	287028.7
1992-93	69869.2	211123.5	162.3	13480.4	6726.3	301361.7
1993-94	70462.5	233150.8	310.8	14727.8	5397.7	324049.6

Source: Central Electricity Authority

The power generating capacity , owned and operated by utilities, has grown at a rate of over 10% per year since 1950. The shares of hydro power and thermal power have changed substantially. The share of hydro capacity declined from 43.4% in 1970-71 to 39% in 1980-81 and further reduced to 25.5% in 1994-95.

It is difficult to strike an optional balance between Hydro and Thermal power, as it may depend upon the system load curve, performance of various types of plants etc.

Perhaps, one of the most important reasons for the decline in the share of hydro electricity is that its gestation period is larger than that of thermal capacity. This is, because, equipment and construction procedures for thermal projects are largely independent of site conditions and can, therefore, be standardized. Hydro-development has also lagged behind due to inter-state disputes and sharing of water, inadequate funding and on account of environmental considerations with addition to installed capacity, gross utility generation also increased rapidly.

CHART 10 : PERCENTAGE OF HOUSEHOLDS USING DIFFERENT FUELS FOR COOKING, 1991

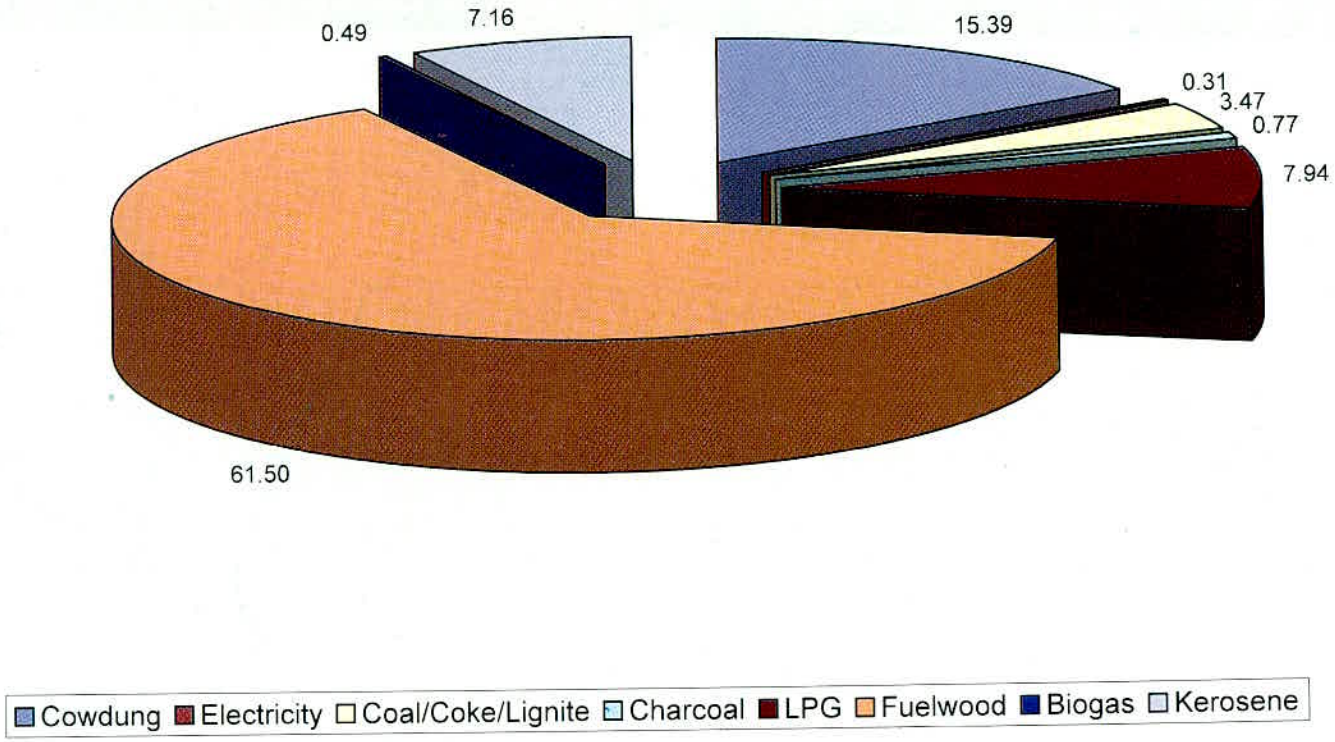


TABLE 4.2.6 : NUMBER OF TOWNS AND VILLAGES ELECTRIFIED IN INDIA AS PER 1981 CENSUS

(as on 31-3-96)

State/Union Territory	Towns			Villages		
	Total	Electrified	Percentage	Total	Electrified	Percentage
State						
Andhra Pradesh	252	252	100.0	27379	27358	99.9
Arunachal Pradesh	6	6	100.0	3257	2270 $	69.7
Assam	80	80	100.0	21995	21887 $	99.5
Bihar	220	220	100.0	67546	47805 $	70.8
Goa	17 *	17	100.0	386	377 $	97.7
Gujarat	255	255	100.0	18114	17892	98.8
Haryana	81	81	100.0	6745	6745	100.0
Himachal Pradesh	47	47	100.0	16807	16761 $	99.7
Jammu & Kashmir	58	58	100.0	6477	6274 $	96.9
Karnataka	281	281	100.0	27028	26483	98.0
Kerala	106	106	100.0	1219	1219	100.0
Madhya Pradesh	327	327	100.0	71352	67741	94.9
Maharashtra	307	307	100.0	39354	39106	99.4
Manipur	32	32	100.0	2035	2016 $	99.1
Meghalaya	12	12	100.0	4902	2407	49.1
Mizoram	6	6	100.0	721	617 $	85.6
Nagaland	7	7	100.0	1112	1099	98.8
Orissa	108	108	100.0	46553	33871	72.8
Punjab	134	134	100.0	12342	12342	100.0
Rajasthan	201	201	100.0	34968	30620	87.6
Sikkim	8	8	100.0	440	405	92.0
Tamil Nadu	434	434	100.0	15831	15822	99.9
Tripura	10	10	100.0	4727 #	3640 $	77.0
Uttar Pradesh	704	704	100.0	112566	86639 $	77.0
West Bengal	291	291	100.0	38024	29205 $	76.8
Union Teritorry						
Andaman & Nicobar Islands	1	1	100.0	491	491	100.0
Chandigarh	4	4	100.0	24	24	100.0
Dadra & Nagar Haveli	1	1	100.0	70	67	95.7
Daman & Diu	-----	-----	-----	26	26	100.0
Delhi	30	30	100.0	214	214	100.0
Lakshadweep	3	3	100.0	7	7	100.0
Pondicherry	6	6	100.0	291	291	100.0
All India	4029	4029	100.0	583003	501721	86.1

: As per 1971 census

* : Separate figures for Daman & Diu are not available

$: Balance villages non-feasible

Source : General Review, 1995-96, Central Electricity Authority

TABLE 4.2.7 : STATEWISE COAL RESERVES, AS ON JAN. 1, 1998

(in million tonnes)

State	Proved	Indicated	Inferred	Total
Andhra Pradesh	6988.20	3203.36	2935.67	13127.23
Arunachal Pradesh	31.23	11.04	47.96	90.23
Assam	228.37	26.83	65.01	320.21
Bihar	33982.71	28116.41	5897.59	67996.71
Madhya Pradesh	11388.25	21903.81	8824.29	42116.35
Maharashtra	3810.25	1304.76	1663.64	6778.65
Meghalaya	117.83	40.89	300.71	459.43
Nagaland	3.43	1.35	15.16	19.94
Orissa	7677.61	22768.45	17930.40	48376.46
Utter Pradesh	574.80	487.00	0.00	1061.80
West Bengal	10315.07	11215.36	4362.06	25892.49
Total	**75117.75**	**89079.26**	**42042.49**	**206239.50**

Source : Annual Report, 1997-98, Ministry of Coal Govt. of India, New Delhi
As reproduced in Yearbook of Energy - Environment Stattistics(YES), 1998
Bharat Information Technology Services(BIT)

Coal is the most abundant source of commercial energy in India. Coal resources are continually assessed by the Geological Survey of India through regional mapping and exploratory drilling. The total coal reserves (as on 1 January,1998) have been assessed at about 206 billion tonnes of which 75 billion tonnes are proven resources.

Coal production increased rapidly after the nationalisation of coal mines. From about 72.9 million ton in 1970/71, it rose to 211.7 million ton in 1990/91 and to 270 million ton in 1995/96 making India the world's fourth largest coal producer. The increase is predominantly in non-coking coal production. One of the major constraints on the profitability of the coal sector is the low productivity levels in underground mines. The underground mines employ 80% of manpower, but contribute to only 30% of the total output. Since the nationalisation of the coal industry, India's mine planners have chosen opencast mining over underground methods, to enhance productivity and meet production targets. The drawback of extracting the majority of the coal with opencast methods is that its quality is unavoidably affected by contamination of overburden mixes into the coal.

TABLE 4.2.8 : CATEGORYWISE COAL RESERVES AS ON JAN. 1, 1998

(in million tonnes)

Types of Coal	Proved	Indicated	Inferred	Total
Gondwana coal	74736.89	89001.94	41613.65	205352.48
Tertiary coal	380.86	77.32	428.84	887.02
Total	**75117.75**	**89079.26**	**42042.49**	**206239.50**
Coking				
Prime coking	4508.72	804.34	--	5313.06
Medium coking	11111.37	10885.21	1214.91	23211.49
Blendable/semi-coking	482.16	904.04	221.68	1607.88
Subtotal	**16102.25**	**12593.59**	**1436.59**	**30132.43**
Non-coking	59015.50	76485.67	40605.90	179107.07
Total (Coking and Non-coking)	**75117.75**	**89079.26**	**42042.49**	**209239.50**

Source : Annual Report, 1997-98, Ministry of Coal Govt. of India, New Delhi
As reproduced in Yearbook of Energy - Environment Stattistics(YES), 1998
Bharat Information Technology Services(BIT)

TABLE 4.2.9 : ESTIMATED POTENTIAL FOR RENEWABLE ENERGY TECHNOLOGIES IN INDIA

S. No.	Sources/ Systems	Approximate Potential
1	Biogas Plants (No.)	12 Million
2	Improved Woodstoves (No.)	120 Million
3	Biomass	17,000 MW
4	Solar Energy	20 MW/SQ KM
5	Wind Energy	20,000 MW
6	Small Hydro Power	10,000 MW
7	Ocean Energy	50,000MW

Source: Ministry of Non-Conventional Energy Sources, Annual Report 1996-97

The Ministry of Non-Conventional Energy Resources was created in 1992. The main responsibilities of the ministry include the development and utilization of new and renewable sources of energy such as biogas, biomass, solar energy, wind energy, small hydro power, ocean energy, geothermal energy, hydrogen and drought animal power.

TABLE 4.2.10 : STATE-WISE WIND POWER INSTALLED CAPACITY AS ON 31-3-1998

(in megawatts)

State	Demonstration Projects	Commercial Projects	Total
Andhra Pradesh	3.050	52.740	55.790
Gujarat	17.345	149.565	166.910
Karnataka	2.575	14.435	17.010
Kerala	2.025	—	2.025
Madhya Pradesh	0.590	11.700	12.290
Maharashtra	4.600	0.995	5.595
Orissa	1.100	—	1.100
Tamil Nadu	19.355	687.940	707.295
Others	0.465	—	0.465
Total	**51.105**	**917.375**	**968.480**

Source : Annual Report, 1997-98, Ministry of Coal Govt. of India, New Delhi
As reproduced in Yearbook of Energy - Environment Stattistics(YES), 1998
Bharat Information Technology Services(BIT)

Amongst all the renewable energy technologies, windfarms appear to be the most feasible and cost-effective for supplementing the conventional means of power generation on a large scale. Of the many wind technologies, the grid-connected with electric conversion systems are the most promising. The National Wind Resource Assessment Programme of Ministry of Non-Conventional Energy Sources, the largest in the world, has identified 77 locations in 9 states with a generating potential of over 4000 MW of grid quality power.

TABLE 4.2.11 : STATE-WISE SMALL HYDRO STATION INSTALLED/UNDER CONSTRUCTION UPTO 3 MW CAPACITY - 1997-98

S.No.	State	SHP Station installed		SHP Projects Under Construction	
		Number	Capacity(MW)	Number	Capacity(MW)
1	Andhra Pradesh	7	7.01	36	42.10
2	Arunachal Pradesh	30	20.15	17	20.63
3	Assam	2	2.20	--	--
4	Bihar	4	0.04	5	2.46
5	Goa	--	--	2	2.90
6	Gujarat	1	2.00	--	--
7	Haryana	1	0.20	1	0.10
8	Himachal Pradesh	14	9.49	18	11.19
9	Jammu & Kashmir	15	4.37	10	11.20
10	Karnataka	12	17.20	18	23.17
11	Kerala	4	3.52	6	14.00
12	Madhya Pradesh	5	3.25	8	14.40
13	Maharashtra	5	6.82	4	6.20
14	Manipur	6	4.10	4	3.50
15	Meghalaya	1	1.51	7	0.28
16	Mizoram	9	5.36	9	8.80
17	Nagaland	5	3.17	4	5.50
18	Orissa	3	1.26	7	9.92
19	Punjab	4	3.90	8	9.50
20	Rajasthan	5	4.32	1	0.54
21	Sikkim	8	9.25	2	3.20
22	Tamil Nadu	3	4.75	4	6.40
23	Tripura	2	1.01	1	0.10
24	Uttar Pradesh	61	32.54	25	19.73
25	West Bengal	8	7.98	7	9.23
26	Andaman & Nicobar Island	--	--	1	2.25
Total		215	155.40	205	227.30

Source : Annual Report, 1997-98, Ministry of Coal Govt. of India, New Delhi
As reproduced in Yearbook of Energy - Environment Stattistics(YES), 1998
Bharat Information Technology Services(BIT)

In India, power generation in small scale hydro-resources is categorized as micro hydro for projects with an installed capacity of upto 100 kW, mini-hydro upto 2 MW, and small hydro upto 15 MW capacity. The categorization is fairly fluid, but here small hydro refers collectively to micro, mini, and small hydro upto 3 MW capacity.

TABLE 4.3.1 : OZONE DEPLETION POTENTIAL(ODP), GLOBAL WARMING POTENTIAL (GWP) & ATMOSPHERE LIFETIME OF THE COMMON CHLORO-FLORO- CARBON(CFC)

S.No.	CFC/HCFC	ODP	GWP	Atmospheric lifetime (years)
1	CFC-11	1.00	1.00	65.0
2	CFC-12	1.00	2.80-3.40	120.0
3	CFC-13	1.00	2.40	400.0
4	HCFC-22	0.05	0.35	20.0
5	CFC-113	0.80	1.40	90.0
6	CFC-114	1.00	3.90	180.0
7	CFC-115	0.60	7.50	380.0
8	CFC-502	0.19	0.50-1.50	--
9	HFC-152A	0.00	<0.10	2.0
10	HCFC-142B	< 0.05	<0.20	2.1
11	HFC-134A	0.00	0.26	8.0

Source : The State of Environment 1995, Ministry of Environment and Forests

The green-house effect plays a crucial role in regulating the heat balance of the earth. It allows the incoming short-wave solar radiation to pass through the atmosphere relatively unimpeded ; but the long way terrestrial radiation emitted by the earth's surface is partially absorbed and then re-emitted by a number of trace gases in the atmosphere. These gases, known as GHGs(Green House Gases) are : water vapour, carbon-di-oxide, Methane, Nitrous oxide and Ozone in the Troposphere (the lowest 10-15 Kms of the atmosphere) and in the Stratosphere. This natural green-house effect warms the lower temperature.

TABLE 4.3.2 : A SUMMARY OF KEY GREENHOUSE GASES

	CO_2	CH_4	N_2O	CFC-12	HCFC 22 (a CFC substitute)	CF_4 (a perfluoro-carbon)
Pre-industrial concentration	280 ppmv	700 ppbv	275 ppbv	zero	zero	zero
Concentration in 1992	355 ppmv	1714 ppbv	311 ppbv	503 pptv	105 pptv	70 pptv
Recent rate of concentration change per year (over 1980s)	1.5 ppmv/yr 0.4%/yr	13 ppbv/yr 0.8%/yr	0.75 ppbv/yr 0.25%/yr	18-20 pptv/yr 4%/yr	7-8 pptv/yr 7%/yr	1.1-1.3 pptv/yr 2%/yr
Atmospheric lifetime (years)	(50-200)*	(12-17)#	120	102	13.3	50000

Source : IPCC WGI Report, 1994.

* No single lifetime for CO_2 can be defined because of the different rates of uptake by different sink processes

This has been defined as an adjustment time which takes into account the indirect effect of methane on its own lifetime

Global warming can have major physical, environmental and socio-economic consequences, which can be both positive and negative. The estimation of these impacts are complex and marked with uncertainties.

Climate change would cause changes in precipitation patterns, ocean circulation and marine systems, soil moisture, water availability, and sea-level rise. These would make an impact on agriculture, forestry and natural eco-systems like wet-lands and fisheries. Also with rising temperatures, and subsequent increasing heat stress and alteration in patterns of vector-borne diseases, the global population would be more vulnerable to health problems, causing disruptions in settlement patterns and large-scale migration. All these would have significant socio-economic consequences.

TABLE 4.3.3 : LAND AREA AND POPULATION AFFECTED BY ONE METRE SEA LEVEL RISE

State	% of state area inundated	% of state's population affected
Goa	4.84	7.25
Tamil Nadu	0.52	2.91
Orissa	0.81	1.76
West Bengal	1.88	2.35
Andhra Pradesh	0.19	0.93
Gujarat	0.92	1.07
Maharashtra	0.18	1.75
Andaman & Nicobar Island	0.72	N.A.
Karnataka	0.15	0.56
Total	0.41	1.68

Source : The State of the Environment 1995,
Ministry of Environment and Forests.

The projected global warming is expected to increase global sea-level by expanding ocean water, melting mountain glaciers, and causing the ice sheets of Greenland and Antarctica to melt or slide into the oceans. A rise in sea-level would inundate wetlands and lowlands, erode shoreline, exacerbate coastal flooding, increase the salinity of estuaries and aquifers and impair water quality.

India has coastline of about 6000 Kms. Sea-level Rise (SLR) threatens sections of all the coastal states of the country. The region most vulnerable to accelerate SLR is the low-lying coral atolls of the Lakshadweep archipelago. The east coast of India, with a larger frequency of storms and lower continental slopes, is more vulnerable than the west coast to damages from storms surges. According to a study done by Jawahar Lal Nehrru University (1993), a total area of 5763 Sq. Kms. is expected to be directly affected by one meter SLR. The most vulnerable area of the coast to a 1 m SLR are Gujarat, Greater Mumbai, Southern Kerala and the deltas of river Cauveri (Tamil Nadu), Krishna and Godavari (Andhra Pradesh), Mahanadi(Orissa) and the Ganga (West Bengal). Islands of the Lakshadweep archipelago would be totally lost.

TABLE 4.4.1 : TOTAL REGISTERED MOTOR VEHICLES IN INDIA AS ON 31ST MARCH, 1996

(In numbers)

States/UT's	All Vehicles	Transport Vehicles					Non-Transport Vehicles					
		Three Wheelers		Taxis	Buses	Trucks	Two Wheelers	Cars	Jeeps	Tractors	Trailers	Others
		Passengers	Goods									
Andhra Pradesh	2506401	53406	8930	19670	25335	151147	2066976	128653	38476	4354	-	9454
Arunachal Pradesh	14821	209	116	207	1493	2140	7352	1168	1615	247	112	162
Assam	358664	9875	-	6164	10033	57717	195110	38943	10019	7411	7113	16279 @
Bihar	1329709	36793	1476	28488	18184	85374	920652	86256	38576	64749	39117	10044
Goa	211756	2272	-	4616	2514	18107	154115	27047	A	410	-	2675
Gujarat	3377798	147739	50389	28388	33078	169973	2363535	252724	57938	151831	115692	6511
Haryana (P)	954563	13263	3601	542	8372	58343	524235	43815	22501	236040	42561	1290
Himachal Pradesh	119037	1423	2767	8369	4880	16787	61868	10394	6116	5647	138	648
Jammu & Kashmir(P)	195125	10375	-	4527	11769	20327	108930	24050	7191	5295	414	2247
Karnataka	2249890	92136	19013	12213	34182	73963	1599612	204303	33813	70911	72032	37712
Kerala	1170241	127975	-	59865	31733	111762	592688	171801	42256	15104	-	17057
Madhya Pradesh	2309608	28726	6825	8106	36598	96853	1730020	92013	47587	167449	86009	9422
Maharashtra	4032565	229245	106758	59497	41987	163575	2675696	413639	122798	104169	104366	10835
Manipur (P)	61511	1889	243	302	1663	4696	43616	3271	4500	687	485	159
Meghalaya	44715	246	-	2671	1884	9874	12581	7513	7142	402	2034	368
Mizoram	18238	-	766	1328	604	2004	6825	1414	4965	155	164	13
Nagaland	101121	6367	578	1904	3213	22751	20427	20533	21098	2227	644	1379
Orissa	658407	5370	616	4318	10362	47970	509272	28621	22563	22352	-	6963
Punjab	1915059	18945	7698	5124	14438	64140	1320010	93278	16955	371720	309	2442
Rajasthan	1768709	32447	-	13420	33906	97611	1177841	79975	64220	222292	44099	2898
Sikkim	8997	-	-	1928	289	828	2990	519	1363	-	-	1080
Tamil Nadu	2771846	58301	20871	22489	35956	143837	2101787	296088	23749	53323	2412	13033
Tripura	34683	2071	112	509	1230	4701	17809	3587	3190	105	974	395
Uttar Pradesh	2977275	32988	9619	29873	28740	78770	2057408	131848	50398	518598	10462	28571
West Bengal	1198733	14798	-	41298	25575	140645	663801	282526	A	20797	-	9293
Andaman & Nicobar Island	14588	16	5	396	296	1106	10935	588	633	212	54	347
Chandigarh	372729	633	2347	426	1218	2189	309235	40873	15808	-	-	-
Dadra & Nagar Haveli	11015	376	347	138	167	892	6119	2301	445	145	26	59
Daman & Diu	19064	499	656	33	118	640	11858	4317	791	97	34	21
Delhi	2629645	79011	-	13663	27871	133472	1741776	633852	A	-	-	-
Lakshadweep	1723	58	107	-	24	-	1279	6	57	12		180
Pondicherry*	119290	1522	213	1557	1258	2593	95027	13528	1131	1112	832	517
All India Total	33557526	1008974	244053	382029	448970	1784787	23111385	3139444	667894	2047853	530083	192054

@ : Included Govt. Vehicles also for which categorywise breakup is not available

P : Provisional

(A) : Included in cars

Source : Motor Transport Statistics of India, 1997

TABLE 4.4.2 : TOTAL REGISTRED MOTOR VEHICLES IN METROPOLITAN CITIES OF INDIA AS ON 31ST MARCH, 1996

(In Numbers)

Name of City	All Vehicles	Two Wheelers	Three Wheelers		Cars	Jeeps	Taxis	Buses	Trucks	Tractors	Trailers	Others
			Passengers	Goods								
Ahmedabad	571643	441919	34228	6857	56557	4632	3653	14447	8319	97	154	780
Bangalore	900541	669937	39292	7913	121408	5996	3331	11655	21826	3872	3661	11650
Bhopal	222619	158623	7063	1229	13715	15614	1110	3565	7906	8558	3418	1818
Calcutta	--	--	--	--	--	--	--	--	--	--	--	--
Chennai	811916	593750	25320	2611	145222	5944	433	9912	21126	382	374	6842
Cochin	196559	113749	14287	2757	28656	3236	5692	5605	19775	443	1346	1013
Coimbatore	240610	177061	7218	1007	31307	2555	60	3273	10128	3551	1830	2620
Delhi	2629645	1741776	79011	-	633852		13663	27871	133472	-	-	-
Hyderabad	--	--	--	--	--	--	--	--	--	--	--	--
Indore	324740	241780	8772	1604	29481	3824	1136	5128	21231	6027	4491	1266
Jaipur	405499	300294	6040		34614	12070	3331	11673	20379	14116	2669	313
Kanpur	246801	194547	4644	1057	14827	3354	579	1635	8730	15527	1014	887
Lucknow	303356	242946	7346	2215	23917	7754	2462	1750	4553	7453	822	2138
Ludhiana	--	--	--	--	--	--	--	--	--	--	--	--
Madurai	116765	89169	2896	1477	7329	369		3048	6339	2238	786	3114
Mumbai	723632	302513	59222	25327	234853	17845	44842	12277	19357	1120	1143	5133
Nagpur	213404	173154	6918	4570	13187	4156	1225	1728	7263	292	494	417
Patna	219533	150979	10757	243	19559	9817	2245	3202	12193	5255	4586	697
Pune	411880	311748	26222	5145	34496	6232	2601	5814	17713	572	595	742
Surat	330961	282656	13738	3060	25658	1991	669	559	2068	110	172	280
Vadodra	275473	208792	16129	6788	28211	4578	2669	1759	3692	968	1485	402
Varanasi	169516	132045	5083	1298	8311	5329	838	2219	6237	6611	765	780
Visakhapatnam	--	--	--	--	--	--	--	--	--	--	--	--
All India Total	9315093	6527438	374186	75158	1505160	115296	90539	127120	352307	77192	29805	40892

A : Included in cars

— : Not Avaulable

Source: Motor Transport Statistics of India 1997

With the increasing urbanization and industrialization, the transport demand has also increased consequently. The total number of vehicles in India has increased from about 11 million in 1986 to more than 33 million, in 1996, of which about 28% is concentrated in the 23 metropolitan cities. With this has increased the vehicular pollution. The different factors are the types of engines used, the age of the vehicles, poor road conditions and congested traffic. The principal vehicular pollutants are Carbon Monoxide, Oxides of Nitrogen, Hydrocarbons, suspended and particulate matters, a varying amount of Sulphur Dioxide depending on the Sulphur content of the fuel and lead compounds.

TABLE 4.4.3 : COMPARISON OF LEADED VS. UNLEADED PETROL DRIVEN VEHICLES

S.No.	Type of Vehicle	Total vehicles Monitored	Leaded vehicles(without catalytic converters)				Unleaded Vehicles(with catalytic converters)			
			No. Monitored	% age exceeding limit	Average CO % age	Average HC in PPM	No. Monitored	% age exceeding limit	Average CO % age	Average HC in PPM
1	Maruti (all models)	423	285	27.36	2.41	409	138	15.20	1.87	312
2	Fiat/118-NE	64	62	28.84	3.33	1286	2	50.00	3.40	375
3	Contessa/ Ambassador	34	31	33.33	2.70	945	3	33.33	2.40	330
4	Others	26	19	35.00	3.34	425	7	0.00	0.45	80

Total Vehicles monitored = 547

Source: Ministry of Environment and Forests, Annual Report 1996-97

Automobile exhausts accounts for a sizable part of pollution. Their effect on human health is particularly of concern. There is a strong correlation between average blood lead levels and the lead content in gasoline. Hydrocarbons present in the exhaust, particularly, in vehicles with poor combustion cause respiratory problems. In the urban areas with tall buildings, which act as concrete canyons, and in street crossings, the pollutants from vehicles stay for a much larger period. Pollution also causes photochemical smog.

The National Environment Engineering Research Institute (NEERI) has been involved in R&D for developing indigenous, lead-resistant, cost-effective catalytic converter for Indian conditions, under three-phased programme. Under the first phase, which has been completed, the test results indicate that the use of a catalytic converter reduces the Carbon-mono-oxide and hydrocarbons concentrations in petrol-driven vehicles to the tune of 50-60%.

Lead additions are added to petrol to enhance its anti-knock properties. It is estimated that only 30% of the lead is deposited in the engine and the balance 70% is exhausted out of the tail pipe into the atmosphere as inorganic salt which can be readily absorbed by people. While the permissible limit for lead is 2 micro gram per 100 ml of blood, an average citizen in a metropolis in India has a lead level between 3 to 82 micro gram per 100 ml of blood. The first phase of introducing petrol with a maximum lead content of 0.15 gms per litre (which was 0.56 gm/litre) in the four metropolitan cities of Delhi, Mumbai, Chennai and Calcutta has already been implemented by the Ministry of Petroleum and Natural Gas since December 15, 1994.

TABLE 4.4.4 : EMMISSION LIMITS FOR DIESEL DRIVEN VEHICLES

Test	Light absorption Coefficient(Millilitre)	Maximum smoke density	
		Bosch units	Hartridge unit
Full load at a speed pf 60 to 70 per cent of maximum engine rated speed specified by the manufacturer	3.1	5.2	75.0
Free acceleration	2.3	—	65.0

Source : Teri Energy Data Directory & Yearbook, 1996/97

TABLE 4.4.5: PHASED TIGHTENING OF EXHAUST EMMISSION STANDARDS FOR INDIAN AUTOMOBILES

Category	1991	1.4.1996	1.4.2000
Petrol Vehicles : (in grams/km) Two wheelers			
Total ($CO+HC+NO_X$) Three Wheelers	20-42	8.1	4.0
Total ($CO+HC+NO_X$) Passenger Cars :	20-42	12.15	6.0
Total ($CO+HC+NO_X$)	16.3-30.0	11.68-16.76	3.69
Diesel Vehicles : (in grams/KWh) A : Gross Vehicles Weight > 3.5 ton (Heavy Duty Vehicles)			
Total ($CO+HC+NO_X+PM$) B : Gross Vehicles Weight < 3.5 ton (Light duty Vehicles)	35.5	28.0	13.96
Total ($CO+HC+NO_X+PM$)	35.5	28.0	13.96-14.57

CO : Carbon Monoxide
HC : Hydrocarbon
NO_X : Oxides of Nitrogen
PM : Particulate matter

Source : Annual Report, 1997-98, Ministry of Environment & Forests

Stricter emission norms for new vehicles effective from 1.4.2000 have been notified by the Ministry of Surface Transport on 28.8.1997. The Progressive tightening of emission norms for vehicles at manufacturing stage is expected to bring about significant improvement in exhaust emission of new vehicles after March, 2000.

TABLE 4.4.6 : URBAN AIR POLLUTION FROM VEHICULAR EMISSIONS

Pollutant	Source of emission	Contribution (per cent) of the source to total emissions	Remarks
Carbon monoxide	Petrol-driven vehicles	85.0	Contribution of two-wheelers is expected to rise
Unburnt hydrocarbons	Two- and three-wheelers	35 to 65	----
Nitrogen oxides	Diesel-driven vehicles	90 or more	----
Particulates	Diesel-driven vehicles	----	----

Source : Teri Energy Data Directory & Yearbook, 1996/97

In India, Two-wheelers which have generally two-stroke engines are getting popular because of greater fuel economy, better specific power, lower operational and maintenance costs and lower production costs.

However, in two-and three-wheelers, powered by 2-stroke engines, exhaust emissions are the principal source of pollutants.

Diesel vehicular exhaust pollution is due to particulate matter, aldehydes and other toxic pollutants like Carbon-mono-oxide, unburned hydrocarbons and oxides of nitrogen.

TABLE 4.5.1 : NUMBER OF REGISTERED INDUSTRIES.

Year	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94
Manufacturing	98379	99724	103373	105511	107454	113890	116227
Electricity, Gas & Water Supply	458	481	493	518	505	961	542
Repair Services & Cold Storage	3759	3872	4126	4150	4327	4643	4825
All Activities	102596	104077	107992	110179	112286	119494	121594

Source : ASI Summary Results

TABLE 4.5.2 : SUMMARY STATUS OF POLLUTION CONTROL IN 17 CATEGORIES OF INDUSTRIES

S.No.	Category	Total No. of Units	Status (No of Units)		
			Closed	Having adequate facilities to comply with with the standards	Not having adequate facilities to comply with the standards
1	Aluminium	7	1	6	0
2	Caustic Soda	25	0	25	0
3	Cement	116	4	104	8
4	Copper	2	0	0	2
5	Distillery	177	22	122	33
6	Dye & Dying Industries	64	4	56	4
7	Fertilizers	110	8	96	6
8	Iron and Steel	8	0	2	6
9	Leather	70	11	59	0
10	Pesticides	71	6	62	3
11	Petrochemicals	49	0	49	0
12	Pharmaceuticals	251	26	224	1
13	Pulp & Paper	96	16	64	16
14	Refinery	12	0	10	2
15	Sugar	392	25	309	58
16	TPP	97	2	68	27
17	Zinc	4	0	4	0
Total		1551	125	1260	166

Source: Ministry of Environment & Forests Annual Report 1996-97.

Air-borne emissions emitted from various industries are a cause of major concern. These emissions are of two forms, viz., solid particles (SPM) and gaseous emission (SO2, Nox, CO etc.). Liquid effluents, generated from various industries, containing organic and toxic pollutants are also a cause for severe concern. Heavily polluting industries were identified which are included under the 17 categories of highly polluting industries for the purpose of monitoring and regulating pollution from them.

There are 1551 industries in the country falling under the 17 categories of highly polluting industries. Thermal power and fertilizer industries are defaulting in meeting air pollution standards; and sugar and pulp and paper industries are the major defaulters in complying with the norms for liquid effluents.

CHART 11 : SUMMARY STATUS OF POLLUTION IN 17 HIGHLY POLLUTED INDUSTRIES

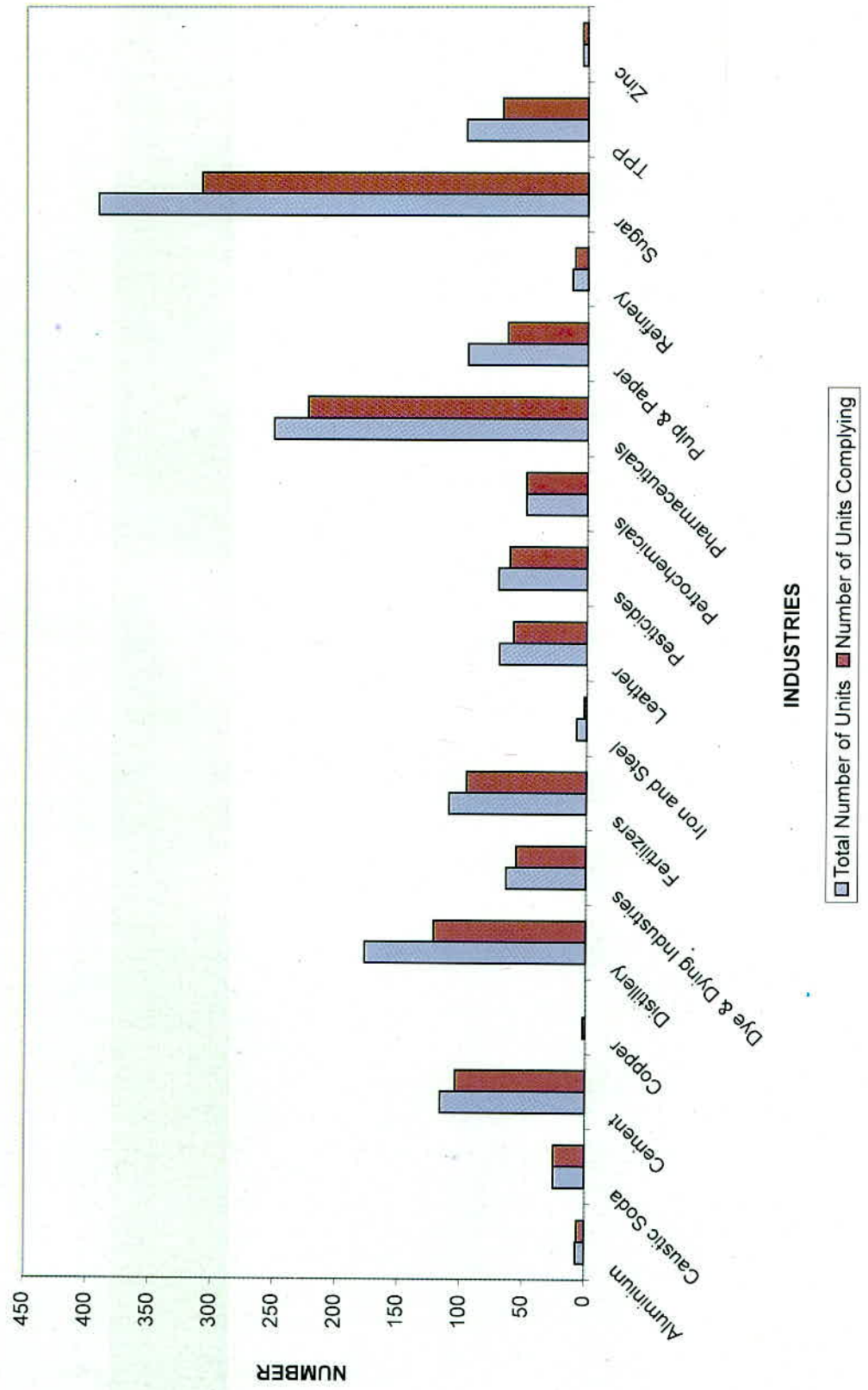


TABLE 4.6.1 : AMBIENT NOISE STANDARDS AS PRESCRIBED BY CENTRAL POLLUTION CONTROL BOARD

S.No.	Area	L_{eq}dB(A)	
		Day Time*	Night Time**
1	Industrial Area	75	70
2	Commercial Area	65	55
3	Residential Area	55	45
4	Silence Zone***	50	40

Source : State of the Environment 1995,
Ministry of Environment and Forests.

Notes :

* Day Time — 0600 hour to 2100 hour (15 hours)

** Night time —2100 hour to 0600 hour (09 hours)

*** Areas upto 100 metres around certain premises like hospitals, educational institutions and courts may be declared as silence zones by the competent authority; honking of vehicle horns, use of loudspeaker, bursting of crackers and hawkers' noise should be banned in these zones.

\+ Mixed areas should be declared as one of four aforesaid areas by the competent Authority and the corresponding limit be applied.

According to study on occupational hazards, even short exposures to intense noise can shift upward the hearing threshold while prolonged exposure or intermittent exposure over a long period produces a damaging effect on hearing resulting in a permanent threshold shift. Accordingly, the Central Pollution Control Board (CPCB) has prescribed norms for noise levels.

TABLE 4.6.2 : AVERAGE NOISE LEVELS IN VARIOUS METROPOLITAN CITIES

(LeqdB(A)

Metropolitan Cities	Day/ Night	Industrial Area	Commercial Area	Residential Area	Silence Area
Calcutta	Day	78	82	79	79
	Night	67	75	65	65
Mumbai	Day	76	75	70	66
	Night	65	66	62	52
Chennai	Day	71	78	66	63
	Night	66	71	48	49
Bangalore	Day	78	76	67	67
	Night	53	57	50	NA

Source : State of the Environment 1995,
Ministry of Environment and Forests.

The noise pollution has already reached at a high level in most of the metropolitan cities in all the residential, commercial, industrial and silence zones. The increasing noise pollution may be attributed to increase in no. of vehicles, urbanization and industrialization. The increase in noise levels may cause impaired hearing ability.

TABLE 4.6.3 : EFFECTS OF NOISE POLLUTION ON HUMAN HEALTH

A. Noise Hazards	
Stage : I Threat to Survival (a) Communication interference (b) Permanent hearing loss	**Stage : II** Causing Injury (a) Neural -humoral stress response (b) Temporary hearing loss (c) Permanent hearing loss
B. Noise Nuisances	
Stage III Curbing Efficient Performance (a) Mental Stress (b) Task Interference (c) Sleep Interference	**Stage IV** Diluting Comfort and Enjoyment (a) Invasion of Privacy (b) Disruption of Social Interaction (c) Hearing Loss

Source:Sound Pollution, During Festivals in West Bengal a growing menace
West Bengal Pollution Control Board

TABLE 4.6.4 : NOISE LEVEL COMPARISON (1993 / 94) AT SELECTED LOCATIONS DURING DURGA PUJA FESTIVAL.

Major Area	Monitoring			Noise level in dB (A)		
	location	day	year	Average	Maximum	Minimum
A. North Calcutta Zone	1.Shyambazar crossing	Saptami	1993	92	99	84
			1994	85	95	82
	2. Bagbazar	Saptami	1993	88	94	85
			1994	99	109	77
	3. Kumartuli	Saptami	1993	89	96	82
			1994	86	98	81
	4. Ahiartola	Saptami	1993	91	99	81
			1994	84	97	76
	5.Chiriamore	Saptami	1993	89	98	82
			1994	94	106	77
	6. Simla Bayam Samity	Astami	1993	95	100	83
			1994	99	100	87
	7. Manicktola	Astami	1993	96	99	89
			1994	90	96	78
B Central Calcutta Zone	8. College Square	Astami	1993	88	98	79
			1994	85	88	78
	9. Ganesh Avenue	Astami	1993	96	101	84
			1994	83	92	74
	10. Bowbazar	Astami	1993	93	100	79
			1994	94	103	81
	11. Mirzapur Street	Astami	1993	94	100	86
			1994	84	96	78
C South Calcutta	12 Ballygunje	Nabami	1993	86	96	77
			1994	80	90	70
	13. Evergreen	Nabami	1993	88	98	79
			1994	90	98	73
	14. Gol Park	Nabami	1993	98	100	95
			1994	81	93	70
	15. Selimpur Palli	Nabami	1993	87	95	76
			1994	84	89	78
	16. Triangular Park	Nabami	1993	88	99	79
			1994	82	88	72
	17.Deshopriya Park	Nabami	1993	88	96	82
			1994	86	91	80

Source:Sound Pollution, During Festivals in West Bengal a growing menace
West Bengal Pollution Control Board

CHAPTER FIVE

LAND AND SOIL

On the basis of nine-fold land-use classification, the land use statistics are available for roughly 305 million hectares out of the total 329 million hectares of the total geographic area, which accounts for 93 % of the total land.

The area under barren and uncultivable lands is generally unsuitable for agriculture, either because of topography or its inaccessibility. Instances are the desert areas in Rajasthan , or the saline land in parts of the Renn of Kutch in Gujarat , the weed infected and ravine land in Madhya Pradesh. Recently the area under non-agricultural uses has increased due to increases in developmental activities, housing, transport systems, irrigation etc. About 22 mha are occupied by the housing, the industry and for other non-agricultural uses, 19.5 mha are snowbound and remote, leaving only 264 mha for agriculture, forestry, pasture, and other biomass production. The net sown area increased from 119 mha in 1950 / 51 to 140 mha in 1970 / 1971, mostly through reclamation of old fallow and cultivable wastelands and diversion of groves. Since 1970 / 1971, the net area sown has particularly remained the same at 142 mha.

5.1 LAND DEGRADATION

Land degradation may be defined as the loss of utility or potential utility or the reduction, loss or change of features or organisms, which cannot be replaced.

Land is degraded when it suffers a loss of intrinsic qualities or a decline in its capabilities. Land degradation may be due to natural causes or human causes or it may be due to combination of both.

5.2 SOIL EROSION

Soil is the non-renewable natural resource, which supports life on earth. About 130 million-hectare of land (45 % of total geographical area) is affected by serious soil erosion through ravine and gully, shifting cultivation, cultivated wastelands, sandy areas, deserts and water logging (Govt. of India, 1989).

Soil erosion by rain and river that takes place in hilly areas causes landslides and floods, while cutting trees for firewood, agricultural implements and timber, grazing by a large number of

livestock over and above the carrying capacity of grasslands, traditional agricultural practices, construction of roads, indiscriminate (limestone), quarrying and other activities, have all led to the opening of hill-faces to heavy soil-erosion. Wind erosion causes expansion of deserts, dust storms, whirlwinds and destruction of crops, while moving sand covers the land and makes it sterile.

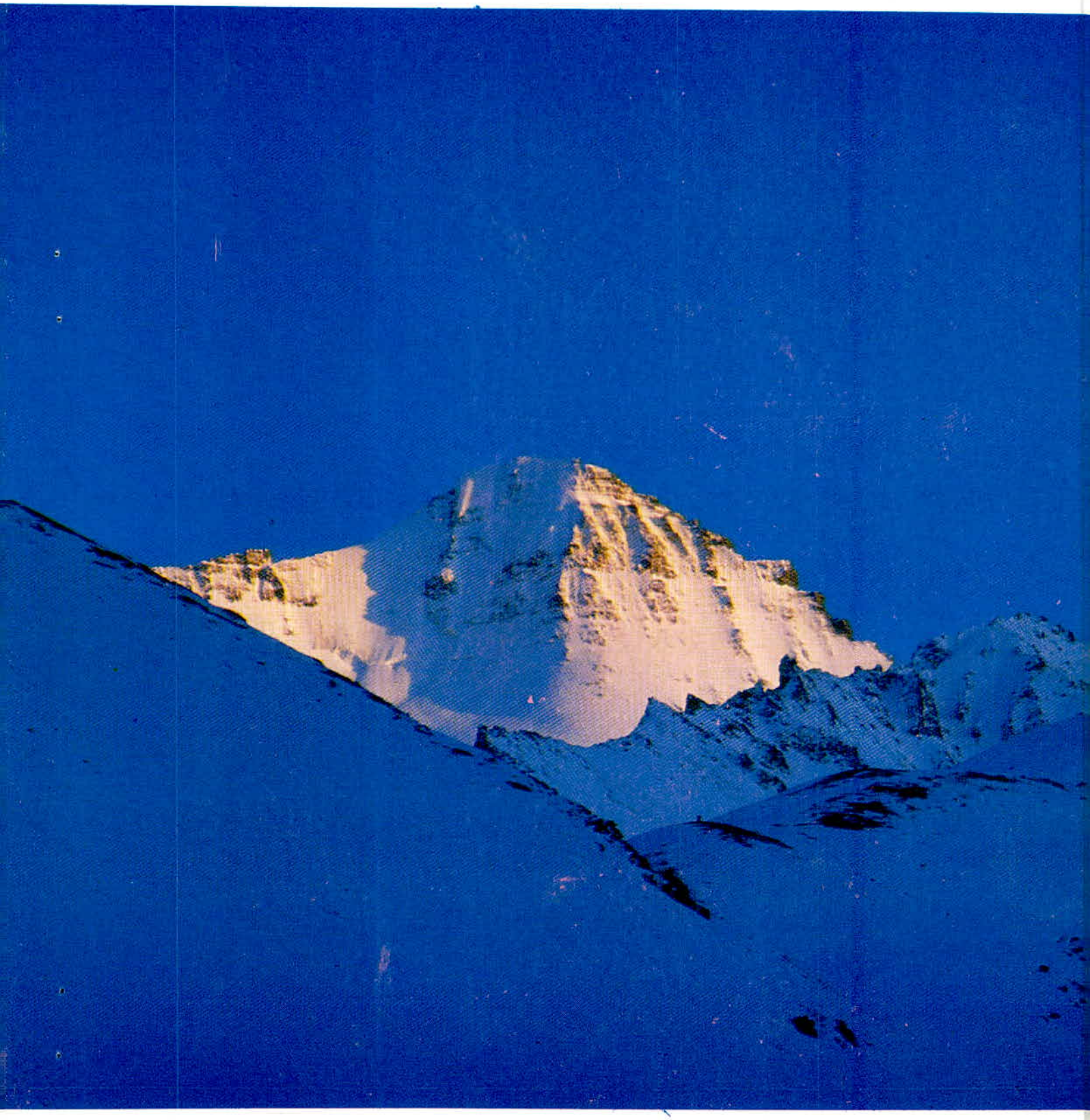
Soil erosion results in huge loss of nutrients in suspension or solution, which are removed away from one place to another, thus causing depletion or enrichment of nutrients. Besides the loss of nutrients from the topsoil, there is also degradation through the creation of gullies and ravines which makes the land unsuitable for agricultural production. Subsidence of the land in some areas and landslides in the hilly tracts are problems affecting highways, habitants and irrigation dams.

The use of pesticides above permissible limits enters the food chain, causing health hazards. A major concern particularly about chlorinated hydrocarbons like DDT is their persistence in soil.

Among fertilizers, the conversion of fertilizer-N to gaseous forms – ammonia (NH_3) and various oxides of Nitrogen - lead to atmospheric pollution. Escape of fertilizer-N as ammonia gas is called ammonia volatilization. Atmospheric ammonia contaminates water bodies, impairs visibility and causes corrosion. Nitrous oxide also contributes to global warming.

5.3 MINING

The mining activities in the country are governed by the Mineral Conservation Development Rules (MCDR)1988. Every license holder or mining lease shall take all possible precautions for protection of environment and control of pollution while conducting prospecting , mining, beneficiation or metallurgical operations in the area. Specific provisions for proper removal and utilization of top soil , storage of over burden and waste rocks, reclamation and rehabilitation or lands precautions against air pollution , noise and ground vibrations , restoration of flora, discharge of toxic liquid ,control of surface subsidence have been provided under the MCDR The statistics are collected by the Indian Bureau of Mines on all these aspects.



SNOW CLAD MOUNTAIN IN LADHAKH

TABLE 5.1.1 : LAND USE CLASSIFICATION IN INDIA

(in Mha)

Classification	1950-51	1960-61	1970-71	1980-81	1990-91	1991-92	1992-93P	1993-94P	1994-95P
I. Geographic area	328.73	328.73	328.73	328.73	328.73	328.73	328.73	328.73	328.73
II. Reporting Area for land utilisation statistics(1 to 5)	284.32	298.46	303.76	304.15	304.86	304.90	304.85	304.88	304.87
1. Forests	40.48	54.05	63.91	67.47	67.80	67.87	67.98	68.28	68.39
2. Not available for cultivation(a+b)	47.52	50.75	44.64	39.62	40.48	40.74	40.89	40.90	41.28
(a) Non Agricultural Uses	9.36	14.84	16.48	19.66	21.09	21.47	21.77	22.21	22.51
(b) Barren and unculturable land	38.16	35.91	28.16	19.96	19.39	19.27	19.12	18.69	18.77
3. Other uncultivated land (excluding fallow land(a+b+c)	49.45	37.64	35.06	32.31	30.22	30.05	29.47	29.07	29.07
(a)Permanent Pastures and other grazing land	6.68	13.97	13.26	11.97	11.40	11.3	11.10	10.97	11.24
(b) Miscellaneous tree crops and groves	19.83	4.46	4.30	3.60	3.82	3.76	3.78	3.70	3.63
(c) Culturable Wasteland	22.94	19.21	17.50	16.74	15.00	14.99	14.59	14.41	14.21
4. Fallow Land (a+b)	28.12	22.82	19.88	24.75	23.36	24.61	23.86	24.21	23.30
(a) Fallow land other than current Fallows	17.44	11.18	8.76	9.92	9.66	9.94	9.67	9.83	9.77
(b) Current Fallows	10.68	11.64	11.12	14.83	13.70	14.67	14.39	14.38	13.53
5. Net area sown(6-7)	118.75	133.20	140.27	140.00	143.00	141.63	142.65	142.42	142.82
6. Gross cropped area	131.89	152.77	165.79	172.63	185.74	182.24	185.62	186.60	188.15
7. Area sown more than once	13.14	19.57	25.52	32.63	47.98	40.61	42.97	44.18	45.33
8. Cropping intensity*	111.10	114.70	118.20	123.30	129.88	128.67	130.12	131.02	131.74
III. Net irrigated area	20.85	24.66	31.10	38.72	47.78	49.87	50.30	51.34	53.00
IV. Gross irrigated area	22.56	27.98	38.19	49.78	62.47	65.68	66.76	68.25	70.64

Source: Agriculture Statistics at a Glance, 1998
Department of Agriculture & Cooperation
Ministry of Agriculture

P: Provisional

* : Cropping Intensity is obtained by dividing the gross cropped area by the net area sown

Out of total geographic area of 329 mha, only 305 mha is the reporting area (the rest being unadministered for various reasons). About 23 mha are occupied for non-agricultural uses (housing, industry and others), 19 mha are snow bound and remote leaving only 263 mha for agriculture, forestry, pasture and other bio-mass production. The net sown area increased from 119 mha in 1950-51 to 140 mha in 1970-71 mostly through reclamation of old fallow and culturable wastelands and diversion of groves. Net area sown has increased only marginally from 140 mha in 1970-71 to 143 mha in 1994-95, indicating that the private efforts have peaked abd the intervention of the Government is required for further land reclamation.

CHART 12 : LAND USE CLASSIFICATION IN INDIA

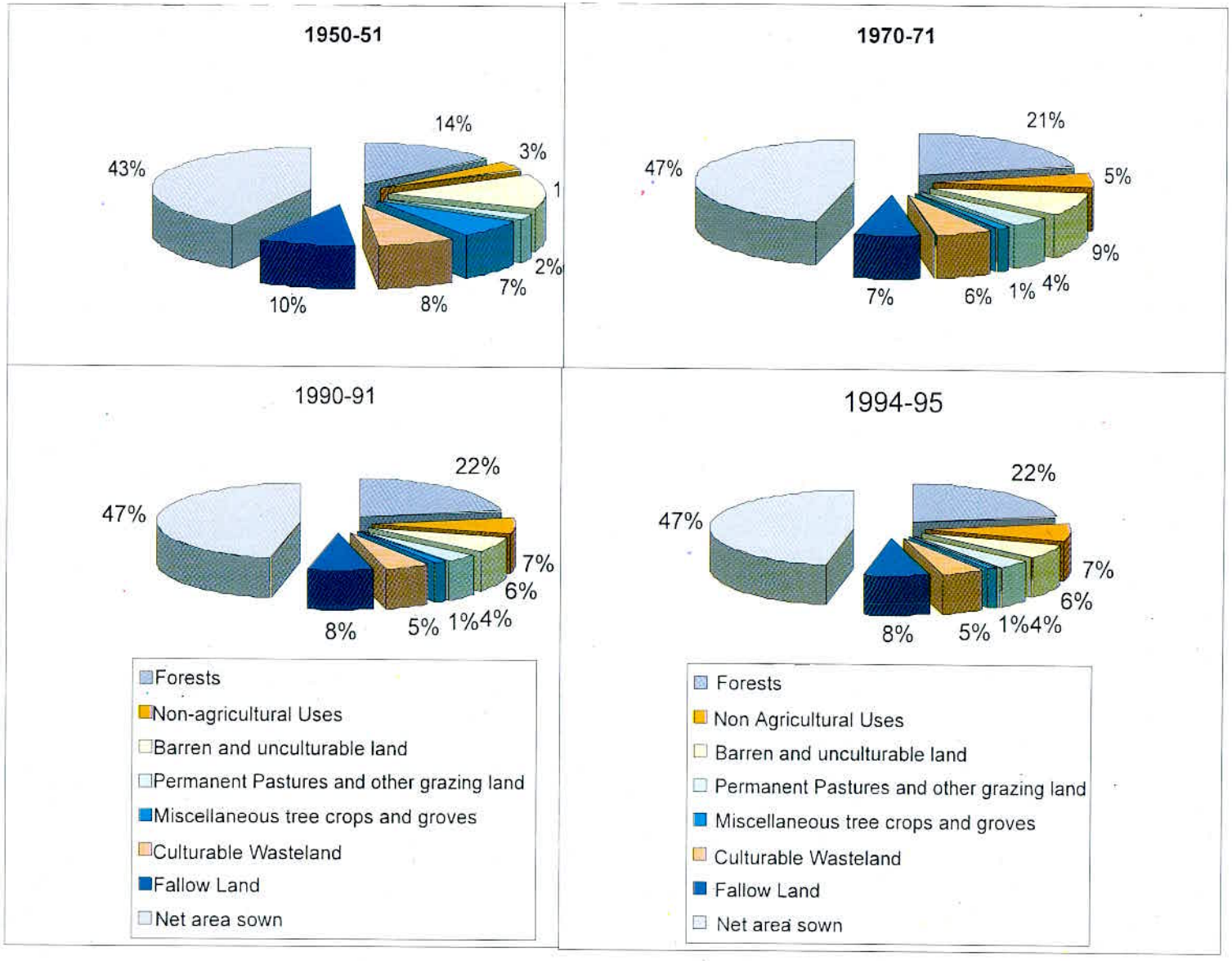


TABLE 5.1.2 : SELECTED CATEGORIES OF LAND USE CLASSIFICATION

(In Mha)

Years	Net sown area	Gross sown area	Area sown more than once	Net irrigated area	Gross irrigated area	Area irrigated more than once
1950-51	118.75	131.89	13.14	20.85	22.56	1.71
1960-61	133.20	152.77	19.57	24.66	27.98	3.32
1970-71	140.27	165.79	25.52	31.10	38.19	7.09
1980-81	140.00	172.63	32.63	38.72	49.78	11.06
1985-86	140.90	178.46	37.56	41.86	54.28	12.42
1990-91	143.00	185.74	42.74	47.78	62.47	14.69
1991-92	141.63	182.24	40.61	49.87	65.68	15.23
1992-93P	142.65	185.62	42.97	50.30	66.76	16.46
1993-94P	142.42	186.00	44.18	51.34	68.25	16.91
1994-95P	142.82	188.15	45.33	53.00	70.64	17.64

Source: Agriculture Statistics at a Glance, 1998
Department of Agriculture & Cooperation
Ministry of Agriculture

The net area under irrigation has increased from 21 mha in 1950-51 to 53 mha in 1994-95. The development in irrigation potential is largely due to the efforts of the Govt. in developing irrigation facilities through major/medium and minor irrigation projects.

Ground water sources contributed nearly 51% of the total area irrigated in 1991-92. There has been a drastic increase in the utilization of ground water since the 1960's due to rural electrification. As a result our ground water resources are getting depleted .Surface water sources, rivers, canals, tanks and rivulets have also been affected considerably due to the degradation and salutation of riverbeds.

TABLE 5.1.3 : STATEWISE INFORMATIONS ON PRIORITY WATERSHEDS OF RIVER VALLEY PROJECTS/FLOOD PRONE RIVERS CATCHMENTS

(Area in Lakh hectare)

S No.	State/UT	Total Area	Surveyed Area	Total SWS*	Very High		High		Total Priority	
					SWS	Area	SWS	Area	SWS	Area
1	Andhra Pradesh	57.53	57.53	1667	231	4.68	353	9.71	584	14.39
2	Arunachal Pradesh	21.75	11.38	437	151	4.09	110	3.02	261	7.11
3	Assam	5.73	5.73	140	18	0.73	15	0.76	33	1.47
4	Bihar	111.11	109.88	4031	560	14.55	813	20.20	1373	34.75
5	Delhi	1.06	1.06	48	8	0.09	4	0.08	12	0.17
6	Gujarat	4.80	4.80	189	35	0.65	58	1.41	93	2.06
7	Haryana	12.05	12.05	435	76	1.83	48	1.34	124	3.17
8	Himachal Pradesh	32.65	32.65	1697	520	9.52	418	7.39	938	16.91
9	Jammu & Kashmir	2.75	2.75	143	38	0.69	25	0.48	63	1.17
10	Karnataka	108.33	108.33	3221	317	11.90	438	14.25	755	26.15
11	Kerala	2.85	2.85	112	24	0.46	29	1.11	53	1.47
12	Madhya Pradesh	264.29	259.78	9001	1203	26.42	1677	42.27	2880	68.69
13	Maharashtra	213.54	213.54	5673	461	17.41	852	31.83	1313	49.24
14	Manipur	10.60	7.56	230	71	2.47	73	2.28	144	4.75
15	Nagaland	6.18	6.18	125	72	3.36	13	0.60	85	3.96
16	Orissa	39.91	39.91	1446	278	7.88	265	6.67	543	14.55
17	Punjab	2.83	2.83	119	17	0.24	7	0.15	24	0.39
18	Rajasthan	27.40	27.40	1009	185	4.24	179	3.94	364	8.18
19	Sikkim	9.68	4.09	97	39	1.74	12	0.40	51	2.14
20	Tamil Nadu	5.48	5.48	204	25	0.57	10	0.25	35	0.82
21	Tripura	0.45	0.45	34	7	0.09	18	0.26	25	0.35
22	Uttar Pradesh	69.54	67.55	2794	458	8.39	773	17.06	1231	25.45
23	West Bengal	32.95	32.95	1292	77	1.98	134	3.32	211	5.30
24	Dadra & Nagar Haveli	0.10	0.10	5	4	0.08	1	0.02	5	0.10
25	Chandigarh	0.10	0.10	11	6	0.04	-	-	6	0.04
	Total	**1043.66**	**1016.93**	**34160**	**4881**	**124.10**	**6325**	**168.80**	**112.06**	**292.90**

Source: All India Soil and Land Use Survey

SWS: Sub Watershed

TABLE 5.1.4: STATEWISE INFORMATION ON SOILS OF PRIORITY WATERSHEDS OF RIVER VALLEY PROJECTS/ FLOODPRONE RIVER CATCHMENTS

Area in lakh hectares

S No.	State/UT	Catchment Area	Priority Area	Subwatershed area on which reports available
1	Andhra Pradesh	55.80	13.51	5.72
2	Arunachal Pradesh	20.40	6.53	0.25
3	Assam	0.59	0.33	0.24
4	Bihar	62.37	22.43	9.83
5	Delhi	1.06	0.17	0.05
6	Gujarat	4.43	1.71	1.53
7	Haryana	6.31	0.60	0.21
8	Himachal Pradesh	32.32	16.48	3.15
9	Jammu & Kashmir	2.75	1.17	0.16
10	Karnataka	106.88	26.15	8.69
11	Kerala	2.24	1.50	0.64
12	Madhya Pradesh	263.54	68.53	16.93
13	Maharashtra	195.46	42.93	13.63
14	Orissa	30.06	10.31	3.26
15	Rajasthan	27.40	8.18	4.46
16	Sikkim	9.68	2.14	0.99
17	Tamil Nadu	2.63	0.65	0.76
18	Tripura	0.45	0.35	0.04
19	Uttar Pradesh	66.57	24.86	4.45
20	West Bengal	19.72	4.07	7.03
21	Dadra & Nagar Haveli	0.10	0.10	0.12
	Total	**1067.09**	**292.85**	**81.29**

Source: All India Soil and Land Use Survey

SHIFTING CULTIVATION IN NORTH EASTERN REGION

TABLE 5.2.1 : USE OF AGRICULTURAL INPUTS

Programme	Unit	1980-81	1990-91	1992-93	1993-94	1994-95	1995-96	1996-97
1. Seeds								
I. Production of Breeder Seeds	Thousand Quintals	5.27	33.89	36.00	37.00	40.11	43.36	44.62
II. Production of Foundation Seeds	Lakh Quintals	--	3.35	3.93	4.06	4.73	4.76	5.67
III. Distribution of Certified/Quality Seeds	Lakh Quintals	25.01	57.10	60.33	62.20	65.86	69.90	70.00
2. Consumption of Chemical Fertilizers								
I. Nitrogenous(N)	Lakh Tonnes	36.78	79.97	84.27	87.89	95.07	98.23	103.02
II. Phosphatic(P)	Lakh Tonnes	12.14	32.21	28.44	26.69	29.32	28.98	29.77
III. Ptassic(K)	Lakh Tonnes	6.24	13.28	8.84	9.08	11.25	11.56	10.29
Total (I.+II.+III.)	Lakh Tonnes	55.16	125.46	121.55	123.66	135.64	138.77	143.08
	Kg./ha	31.83	67.49	65.33(E)	66.69(E)	73.12(E)	74.43(E)	76.75
3. Consumption of Pesticides(Technical Grade Material)	Thousand Tonnes	45.00	75.00	70.79	63.65	61.36	61.26	56.11
4. Area under High Yielding Varieties					(Achievements)			
Paddy	Million ha	18.23	27.39	27.48	28.71	30.84	31.08	NA
Wheat	Million ha	16.10	20.97	21.70	22.12	23.14	23.39	NA
Jowar	Million ha	3.50	7.06	6.92	6.76	7.28	7.49	NA
Bajra	Million ha	3.64	5.70	5.62	5.20	5.18	5.44	NA
Maize	Million ha	1.60	2.61	2.58	3.02	3.39	3.53	NA
Ragi	Million ha	--	1.25	1.10	1.18	1.10	1.18	NA
Total	Million ha	43.08	64.98	65.40	66.99	70.93	72.11	NA
5. Area covered under Soil Conservation (Cummulative)	Million ha	24.37	34.90	36.51	37.30	38.20	39.18	40.23
6. Irrigated Area	Million ha	54.1	70.8	74.5	76.2	77.9*	79.9*	NA
Major & Medium	Million ha	22.7	26.0	26.6	27.1	27.7	28.4	NA
Minor @	Million ha	31.4	44.8	47.9	49.1	50.2	51.5	NA

* : Provisional Ant : Anticipated (E) : Estimated

@ : The figures for minor irrigation indicate the net benefit after allowing for seepage.

Source : Agricultural Statistics at a Glance, 1998.
Department of Agriculture & Cooperation
Ministry of Agriculture

TABLE 5.2.2 : PERFORMANCE OF CROP PRODUCTION

Crops	Production (in million tonnes)					Growth rate during 1996-97 in percent p.a. assumed base level 1991-92
	1991-92	1992-93	1993-94	1994-95	1996-97	
Rice	74.68	72.86	80.30	81.81	81.31	1.75
Wheat	55.69	57.21	59.84	65.77	69.27	4.18
Coarse Cereals	25.99	36.59	30.82	29.88	34.28	1.90
Total Cereals	156.36	166.67	170.96	177.46	184.86	2.61
Total Pulses	12.02	12.82	13.30	14.04	14.46	2.47
Total Foodgrains	168.38	179.48	184.26	191.50	199.32	2.60
Sugarcane	254.00	228.03	229.66	275.54	277.30	3.63
Total Oilseeds	18.60	20.11	21.50	21.34	24.96	5.12
Cotton @	9.71	11.40	10.74	11.89	14.25	7.04
Jute & Mesta #	10.29	8.59	8.43	9.08	11.00	1.38
Non Foodgrains *	158.80	164.00	169.50	180.90	201.10	4.72
All Crops *	145.50	151.60	157.30	165.00	175.70	3.39

@ : Production in million bales of 170 kgs. each
# : Production in million bales of 180 kgs. each
* : Index number base : 1981-82 = 100

Source : Agricultural Statistics at a Glance, 1998.
Department of Agriculture & Cooperation
Ministry of Agriculture

The crop yields have increased greatly in India over the past 20-25 years. Most of these increases have been due to the development of crop varieties which respond to fertilizers. The different types of cropping systems practised in traditional agriculture have given way to systems involving only a few crops which are highly nutrient depleting but high yielding. The legumes, grasses, and millets which were regular components of cropping systems in Indian agriculture have largely been phased out in highly productive areas due to poor economic returns and replaced by high yielding rice, wheat, sugarcane, etc. As a result, the water table is receding at an alarming rate. This has created the problems of soil erosion and the destruction and disturbances to wild life habitats.

TABLE 5.2.3 : AREA UNDER PRINCIPAL CROPS

(in million hectares)

Crops	1970-71	1980-81	1990-91	1994-95	1996-97
Rice	37.6	40.2	42.7	42.2	43.3
Wheat	18.2	22.3	24.2	25.6	25.9
Pulses	22.5	22.5	24.7	23.2	23.2
Foodgrains	124.3	126.7	127.8	123.5	124.5
Cotton	7.6	7.8	7.4	7.9	9.1
Jute & Mesta	1.1	1.3	1.0	0.9	1.1
Sugarcane	2.6	2.7	3.7	3.8	4.2
Tobacco	0.5	0.5	0.4	0.4	0.4
Oilseeds	16.6	17.6	24.1	25.3	26.81

Source : Department of Agriculture and Cooperation

TABLE 5.2.4 : CONSUMPTION OF TECHNICAL GRADE PESTICIDES

(in tonnes)

Names	1971	1994-95 *
Insecticides	22013	51755
Fungicides	2067	22895
Herbicides	30	7620
Rodenticides	195	1860
Others	NA	900
Total	**24305**	**85030**

Source : Teri Energy Data Directory & Yearbook, 1996-97
* : Projected

Most part of the applied pesticide, irrespective of crop, applicator or the formulation used, ultimately finds its way into the soil. Before pesticides are completely inactivated, they may adversely affect the functioning of non-target microbes and other forms of life inhabiting the soil. They may also be taken up by the plants or get translocated in the aquatic system by leaching or run-off, thus contaminating the plankton, fish, invertebrate and other forms of life using their water.

Pesticide residues in food items have been a matter of considerable concern. Even small quantities of these residues ingested daily along with food can build up high levels in the body fat. The long term effects of these residues in the human body include carcinogenecity, reduced life span and fertility, increased cholesterol, high infant mortality and varied metabolic and genetic disorders.

TABLE 5.2.5 : CONSUMPTION OF CHEMICAL FERTILIZERS

(thousand tonnes)

Year	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)	Total
1960-61	210.0	53.1	29.0	292.1
1970-71	1487.0	462.0	228.0	2177.0
1980-81	3678.1	1213.6	623.9	5515.6
1990-91	7997.2	3221.0	1328.0	12546.2
1991-92	8046.3	3321.2	1360.5	12728.0
1992-93	8426.8	2843.8	883.9	12154.5
1993-94	8788.6	2669.3	908.4	12366.3
1994-95	9507.1	2931.7	1124.7	13563.5
1995-96	9822.8	2897.5	1155.8	13876.1
1996-97	10302.0	2977.0	1029.0	14308.0
1997-98 (Likely)	11738.0	4109.0	1471.0	17318.0

Source : Agricultural Statistics at a Glance, 1998.
Department of Agriculture & Cooperatic n
Ministry of Agriculture

TABLE 5.2.6 : INSECTICIDE LEVELS IN SOIL

Location	Year	No. of Samples		Insecticide Detected	Residue (PPM)
		Analysed	Contaminated		
Uttar Pradesh	1966	138	120	DDT	0.67-15
Punjab	1978	108	91	DDT	0.17-1.63
				HCH	0.5
	1979	12	12	DDT	0.036-.0.08
				HCH	0.032-0.32
	1980	16	12	DDT	0.02-0.09
				HCH	0.02-0.05
Karnataka	1973	—	—	HCH	0.125
Delhi	1979	50	49	DDT	0.08-4.88
	1981	—	—	DDT	0.01-2.61
	1986	50	50	DDT	0-2.6

Source : State of the Environment, 1995

TABLE 5.2.7 : INSECTICIDE LEVEL IN WATER

Location	Year	No. of Samples		Insecticide Detected	Residue	
		Analysed	Detected		Water	Sediments
Yamuna River						
Delhi						
Upstream	1979	12	12	DDT	0.1-0.528	0.007-1.121
Downstream	1979	9	9	DDT	0.063-0.404	0.010-0.258
Wazirabad						
Upstream	1979	14	14	DDT	0.062-0.639	0.017-1.121
Downstream	1979	15	15	DDT	0.083-3.416	0.012-1.326
Ujjain	1989	--	--	HCH	2.720	--
				DDT	0.219	--
				ALABIN	5.000	--
Kala	1989	--	--	HCH	.0154-1.412	--
	1989	--	--	HCH	0.166	--
				DDT	0.166	--

Source : State of the Environment, 1995

TABLE 5.3.1 : FREQUENTLY OCCURRING NATURAL DISASTERS IN INDIA

Type	Location/ Area	Affected Population (in Million)
Cyclones	Entire 5700 km long coastline of Southern, Peninsular India covering 9 States viz Gujarat, Maharastra,Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal and Union Territory of Pondicherry besides Islands of Lakshadweep and Andaman and Nicobar	10
Floods	8 major river valleys spread over 40 million hectares of area in the entire country	260
Drought	Spread in 14 States of Andhra Pradesh, Bihar,Gujarat,Haryana, Jammu & Kashmir,Karnataka, Madhya Pradesh,Maharashtra, Orissa,Rajasthan,Tamil Nadu, Uttar Pradesh,West Bengal & Himachal Pradesh covering a total of 116 districts and 746 blocks	86
Earthquake	Nearly 55% of the total area of the country falling in the seismic zone IV & V.	400
Landslide	Entire sub Himalayan region and Western Ghats	10
Avalanche	Many parts of the Himalaya	1
Fire	States of Bihar, West Bengal, Orissa and north eastern States	140

Source State of the Environment, 1995, India

India is prone to natural disasters. Due to its locational and geographical features, it is vulnerable to a number of natural hazards like cyclones, droughts, floods, earthquakes, fires, landslides and avalanches.

Natural disasters result in heavy economic losses, apart from the loss of human life and the hardship inflicted on the survivors. On an average, atleast one major disaster hits India every year, causing irrepairable damage to life and property.

TABLE 5.3.2 : RECENT NATURAL DISASTERS IN INDIA

Type	Location/area	Affected population (Million)	Loss of human lives	Loss of crops & Public property (Rs billion)
Cyclone (May 1990)	Andhra Pradesh	7.78	928	22.470
Earthquake (October 1991)	Uttarkashi,U.P.	0.40	768	0.890
Cyclone (Nov. 1992)	Tamil Nadu, Kerala & Karnataka	0.80	497	8.023
Floods (June-Sept,1993)	12 States of Assam, Arunachal Pradesh West Bengal, Bihar, Punjab,Uttar Pradesh, Jammu & Kashmir, Himachal Pradesh, Haryana, Tripura, Mizoram and Maharashtra were affected by floods	28.80	1643	21.060
Earthquake (30 Sept.1993)	Marathwada in Maharashtra,Karnataka & Andhra Pradesh	0.20	7611	3.100
Cyclone (December 1993)	Tamil Nadu & Pondicherry	-	-	8.850

Source : State of the Environment, 1995, India

TABLE 5.4.3: STATUS OF AFFORESTATION AND TREES SURVIVED UPTO 1996-97 IN MINING AREAS

S. No.	Minerals	Mines Covered	Area Covered	Trees Planted	Trees Survived	Survival Rate (%)
1	Asbestos	18	39.64	13866	9059	65
2	Ball Clay	1	0.10	200	167	84
3	Barytes	2	5.20	4500	3075	68
4	Base Metal	1	189.50	397040	277928	70
5	Bauxite	49	1337.79	4614997	3518725	76
6	Calcite	1	2.50	300	120	40
7	Chalk	4	5.50	8700	6734	77
8	China Clay	17	42.09	56039	34528	62
9	Chromite	10	224.96	1154838	659566	57
10	Clay	17	56.43	57366	42229	74
11	Copper	4	268.33	1101156	684956	62
12	Diamond	1	30.05	60518	48414	80
13	Dolomite	11	204.76	351511	226725	65
14	Emerald	1	0.20	200	150	75
15	Felsite	3	1.85	1012	617	61
16	Fire Clay	7	56.96	41394	24560	59
17	Flourspar	4	112.80	935957	748766	80
18	Gold	2	393.10	802022	570024	71
19	Graphite	21	21.82	18677	10988	59
20	Gypsum	19	60.50	26894	19660	73
21	Iron & Manganese	31	160.38	486888	370846	76
22	Iron Ore	109	4500.41	19184290	12938005	67
23	Kyanite	2	2.02	500	350	70
24	Lead-Zinc	7	1310.80	618950	556457	90
25	Limestone	213	5296.06	9835084	6889877	70
26	Magnesite	16	417.64	363393	249893	69
27	Manganese Ore	57	1803.71	4766070	3110294	65
28	Multi minerals	2	6.64	924	915	99
29	Pyrite	1	2.00	5350	2675	50
30	Pyro/Diasp	5	13.80	11675	8908	76
31	Pyrophillite	1	125.00	30000	18300	61
32	Quartz	5	6.12	7790	4545	58
33	Quartz & Felspar	6	13.08	2508	1488	59
34	Rock phosphate	8	134.10	617234	294223	48
35	Sillica sand	21	112.79	75455	42047	56
36	Sillimanite	1	3.17	2252	450	20
37	Slate	11	9.50	13000	5493	42
38	Soapstone/Steatite	41	105.80	113132	79968	71
39	Tungsten	1	13.90	19150	11662	61
40	White Clay	2	7.50	6030	3666	61
41	Wollastonite	3	42.77	96361	93470	97
	Total	736	17141.27	45903223	31570523	69

Source : Indian Bureau of Mines

TABLE 5.4.4: MINING MACHINERY IN METALLIFERROUS OPENCAST MACHANISED MINES DURING 1996-97

S. No.	Machinery	In Use	In Reserve
1	Dipper Shovels	621	83
2	Loaders	447	21
3	Bulldozers	465	43
4	Motor Graders	75	2
5	Haulers/Dumpers	3499	232
6	Drills	884	164
7	Crushers	263	14
8	Air Compressors	790	104
9	Locomotives	32	14
10	Hydraulic Excavators	186	5
11	Cranes	124	8

Source : Indian Bureau of Mines

TABLE 5.4.5 : CONSUMPTION OF EXPLOSIVES FOR MINING (EXCLUDING FUEL, ATOMIC & MINOR MINERALS)

Explosives	Unit	1992-93	1993-94	1994-95	1995-96	1996-97
Gun Powder	Tonnes	54	93	124	354	97
High Explosive	Tonnes	40270	42075	48235	44110	41295
Liquid Oxygen	Tonnes	252	189	211	176	129
Detonators	No.(000)	15588	14580	16195	14336	13452
Fuse	m.(000)	23028	23907	26044	23977	22820

Source : Indian Bureau of Mines

CHAPTER SIX

WATER

India is rich in surface water resources. There is a vast network of rivers and alluvial basins. However, conditions vary widely from region to region. Whereas, some are drought-affected, others are frequently flooded. With the rapid increase in the population, the demand for irrigation, human and industrial consumption of water has increased considerably, thereby causing depletion of water resources. The main preoccupation of water resource development in the country is the extension and improvement of irrigation and hydel power generation. Water requirements for industrial and domestic use are met partly from reservoirs constructed and managed by the irrigation department.

However, a growing threat to water supplies in India is also due to the degradation in quality of water. While drinking water is the largest demand for high water quality, many industrial uses require high quality water as well.

6.1 WATER POLLUTION

The types and sources of water contamination include " point " sources of pollution which usually refers to wastes being discharged from a pipe, and " non-point " sources, which means all other sources such as storm water runoff (which picks up oils and other contaminants from various areas), irrigation (which carries fertilizer and pesticides into groundwater), leaks from storage tanks and leachate from disposal sites. The non-point sources are technically the most difficult to regulate. In India water-pollution comes from three main sources: domestic sewage, industrial effluents and run-off from activities such as agriculture. Water pollution from domestic and human wastewater causes many severe water-borne diseases. The problem of water pollution due to industries is because of the inadequate measures adopted for effluent treatment than to the intensity of industrial activities. The major water polluting industries are leather, tanneries, pulp and paper, textiles, and chemicals.

Access to safe drinking water remains an urgent need as only 72% of the population in the urban area receives organised piped water-supply and the rest have to depend on surface or ground water which is untreated (Statistical abstract of India, 1992). In rural areas, the situation is worst. The diseases commonly caused due to contaminated water are diarrhea, trachoma, intestinal worms, hepatitis, etc. The most common contamination in the water is from the disease-bearing human wastes, which is usually detected by measuring fecal coliform levels. Inadequate access to safe drinking water and sanitation facilities leads to infant mortality and intestinal diseases.

An uncontrolled disposal of urban waste into water bodies, open dumps and poorly designed landfills, causes surface water and ground water contamination. Industrial wastes containing heavy

metals such as mercury, chromium, lead and arsenic can threaten or destroy marine life besides polluting aquatic food resources.

6.2 WATER QUALITY STANDARDS

Drinking water standards for India were set up by the ICMR (Indian Council of Medical Research). These are almost similar to the WHO's (World Health Organization) drinking water standards.

For industries, surface water is the main source for drawing water and discharging effluents. The water quality in surface water bodies depends on discharges at various stretches. Based on water quality criteria, the CPCB has designated water uses for all Indian rivers. This is done through classification of surface water into five categories for various uses such as drinking water source without conventional treatment but after disinfection; outdoor bathing; drinking water source; propagation of wildlife and irrigation, industrial cooling, controlled waste. Discharges of industrial effluents are regulated through the standards prescribed by Indian Standards Codes, is IS 2490 (1974) for discharges into inland surface waters, IS 3306 (1974) for discharges into public sewers, and IS 3307 (1974) for discharges on land for irrigation.

TABLE 6.1.1 : PERFORMANCE OF TOTAL RAINFALL IN A YEAR

Year	As Percentage of Normal Rainfall
1976	102
1977	104
1978	109
1984	96
1985	93
1986	87
1987	81
1988	119
1989	101
1990	106
1991	91
1992	93
1993	100
1994	110
1995	100
1996	103

Source : "Economic Survey - 1996-97", Ministry of Finance, New Delhi.

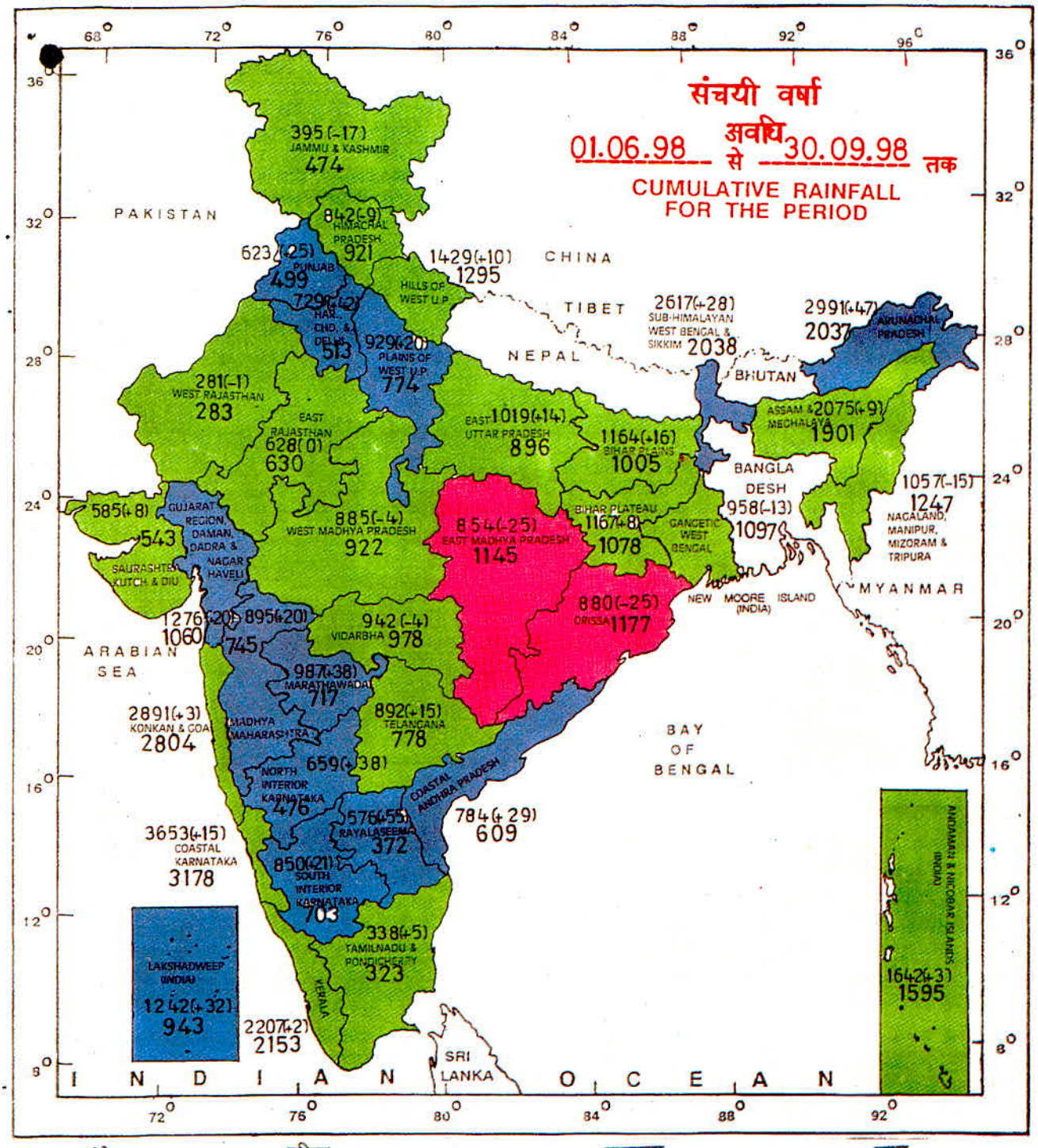
TABLE 6.1.2 : SUB DIVISIONAL ACTUAL AND NORMAL RAINFALL

(In Millimetres)

Sub Divisions	1994		1995		1996	
	Actual	Normal	Actual	Normal	Actual	Normal
1. Andaman & Nicobar Island	2935.1	3067.6	2970.0	3098.8	2975.2	3098.8
2 Arunachal Pardesh	3203.1	4098.6	3787.3	3592.3	4962.7	4357.0
3. Assam and Meghalaya	2429.6	2296.4	2629.2	2308.7	2310.4	2440.0
4 Nagaland,Mizoram, Manipur and Tripura	1701.5	2029.3	2071.8	2003.2	1947.0	2043.0
5. Sub-Himalayan West Bengal & Sikkim	2094.3	2783.9	3595.0	2813.3	2920.5	2773.1
6. Gangatic West Bengal	1648.4	1440.0	2279.4	1459.0	1423.8	1457.8
7. Orissa	1744.1	1458.2	1739.3	1456.6	996.9	1459.3
8. Bihar Plateau	1728.9	1304.9	1580.4	1301.8	1254.7	1337.2
9. Bihar Plain	1069.9	1232.5	1176.3	1225.1	1262.5	1241.3
10. Uttar Pardesh East	970.9	1042.0	940.2	1050.9	1104.5	1055.9
11. Plains of Uttar Pradesh West	753.1	900.5	781.0	851.9	1097.3	887.6
12. Hills of Uttar Pradesh West	1534.8	1945.1	1578.3	1730.7	1662.1	1733.4
13. Haryana,Chandigarh & Delhi	890.9	731.2	949.1	721.3	953.1	727.0
14. Punjab	790.5	628.2	1162.0	764.7	820.2	757.6
15. Himachal Pardesh	1521.9	1667.9	1796.9	1800.2	1604.3	1839.6
16. Jammu & Kashmir	1454.0	1067.5	1334.6	1125.4	1666.8	1128.3
17. Rajasthan West	398.0	319.7	380.7	323.5	446.8	322.9
18. Rajasthan East	888.5	721.6	774.6	722.7	886.3	700.8
19. Madhya Pradesh West	1205.5	1041.2	929.7	1036.1	982.7	1040.2
20. Madhya Pradesh East	1628.0	1352.8	1246.5	1357.2	1123.6	1354.5
21. Gujarat Region	1358.8	845.8	605.9	835.5	829.6	846.4
22. Saurashtra,Kutch & Diu	775.6	539.1	352.2	520.9	502.3	537.1
23. Konkan & Goa	2710.2	2770.7	2364.0	2757.7	2582.4	2754.7
24. Madhya Maharastra	783.2	741.0	701.2	779.1	778.1	763.5
25. Marathwada	563.5	841.7	730.2	807.4	884.9	800.1
26. Vidarbha	1371.6	1111.8	950.6	1121.9	797.1	1099.4
27. Coastal Andhra Pradesh	1128.2	988.0	1327.6	989.3	1300.3	949.3
28. Telangana	828.3	963.0	1174.8	970.6	929.8	970.6
29. Rayalaseema	682.5	733.3	920.5	733.3	1277.4	733.3
30. Tamilnadu & Pondicherry	910.8	1031.5	876.9	1025.3	1343.1	1023.5
31. Coastal Karnataka	4139.6	3560.5	3663.9	3560.5	3355.2	3560.5
32. North Interior Karnataka	845.0	823.9	755.7	815.3	766.4	824.5
33. South Interior Karnataka	988.5	951.5	807.5	947.9	838.3	895.0
34. Kerala	3002.2	2718.6	2499.7	2718.6	2457.2	2718.6
35. Lakshadweep	1452.6	1500.6	1588.7	1543.6	1601.7	1579.9

Source : Indian Meteorological Department , Ministry of Science and Technology

भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT



संकेत LEGEND:

अधिक EXCESS +20% OR MORE या अधिक	सामान्य NORMAL +19% TO -19%	न्यून DEFICIENT -20% TO -59%
विरल SCANTY -60% TO -99%	अनावृष्टि NO RAIN -100%	अपर्याप्त आँकड़े DATA INADEQUATE

Small figures indicate actual rainfall (mm), while bold figures indicate normal rainfall (mm). Percentage departures of rainfall from normal are shown in brackets.

छोटे अंक वास्तविक वर्षा (मि॰मि॰) और बड़े अंक सामान्य वर्षा (मि॰मि॰) दर्शाते हैं । सामान्य से कम अथवा अधिक वर्षा का प्रतिशत कोष्ठकों में दर्शाया गया है ।

TABLE 6.1.3 : ANNUAL RAINFALL BY METEOROLOGICAL SUB -DIVISION

(millimetre)

Sub-division (1)	Actual annual rainfall									
	1976	1981	1990	1991	1992	1993	1994	1995	1996	1997
1.Andaman and Nicobar Islands (2)	3175.1$	2793.3$	2256.9	2465.6	2292.6	2428.1	3044.9	3102.1	3165	2355.7
2.Arunachal Pradesh	2941.0$	3791.4$	5720.5	3309.2	1970.2	2839.3	2141.3	2938.9	2589.7	2742.6
3.Assam and Meghalaya	2366.4$	2177.3$	2426.7	2206.1	12214.5	2993	2350.4	2706.1	2635	2432.5
4.Nagaland,Mizoram,Manipur and Tripura	2093.5$	1686.5$	2265.7	2513.4	1680.5	2384	1412.5	1670	1559.4	1830.9
5.Sub-Himalayan,West Bengal & Sikkim	1540.6	2651.6$	2762.8	3105.6	2027.4	2779.1	1868.6	2896.3	2531.1	2350.9
6.Gangetic West Bengal	1004.7	2019.3$	2167.1	1969.1	1139.7	1663.5	1457.2	1738.6	1399.5	1670.5
7.Orissa	1245.5$	1319.0$	2004	1583.5	1350	1395	1759.8	1725.9	1042.4	1556.8
8.Bihar Plateau	1235.4$	1375.8$	1738	1505.7	983	1224.4	1470	1402.8	1215.8	1494.9
9.Bihar Plains	1308.5$	1271.5$	1011.1	1024.1	780.5	1209.5	957.9	1088.7	1124	1347.6
10.Uttar Pradesh East	870.9	1059.7	1183	833.7	842.3	853.8	985.4	904.5	1047.1	1068
11.Plains of Uttar Pradesh West	650.4	739	839.3	644.6	784	775.8	851.8	869.5	953.4	938.8
12.Hills of Uttar Pradesh West	1030.5	1362.3	1759.9	856	1316.1	1427.5	1269	1398	1259.2	1450.8
13.Haryana,Chandigarh & Delhi	776.5	475.9	910.5	586.4	527.5	661.4	749.3	1066.6	872.2	875.5
14.Punjab	764.3	532.8	1047.6	662.1	561.5	693.3	672.8	877.1	747	896.7
15.Himachal Pradesh	1256.1	1488.3$	1767.3	1319.9	1261.3	1186	1420.5	1458.5	1247.4	1385.1
16.Jammu & Kashmir	668.5	609.7	1238.5	1132.3	1411.5	656.3	1094.5	893.7	1135.8	1045.4
17.Rajasthan West	515.6	259.8	545.8	166.7	606.2	366	509.2	458.4	456.7	568.1
18.Rajasthan East	860.1	684.4	750.4	482.7	801.7	705.9	862.9	808.8	942.2	800
19.Madhya Pradesh West	1049.8	931.3$	1191.8	839.4	833.1	1067.4	1351.7	927.1	1142.6	1118.3
20.Madhya Pradesh East	1180.7	1128.6$	1596.4	1203.5	1127.4	1230.8	1742	1220.8	1125.2	1274.1
21.Gujarat Region,Daman, Dadra & Nagar Haveli	1781.3	1220.4	948.8	536.7	1135.7	1298.7	1933	881.9	1182	1408.7
22.Saurashtra,Kutch & Diu	639.8	679.1	440.3	299.4	597.1	412.5	772.3	402.9	480	660.2
23.Konkan & Goa	3021.9	3041.8	3328.7	2682.5	2727.4	3229.7	3068.4	2692.9	2656	293
24.Madhya Maharashtra	995.6	920.3	876.8	781.3	810.3	1060.7	1105.8	897.8	966	1049.1
25.Marathwada	618.3	939.1	1339.4	665.3	732.3	825.4	608.5	864.1	844.1	794.2
26.Vidarbha	928.8	1187.7	1551.6	817.2	1079.4	980	1443.3	1089.9	843.6	1068.8
27.Coastal Andhra Pradesh	1146.2	980.2	1415.7	1185.2	945.3	877.1	1034.5	1354.3	1251.4	1093
28.Telangana	1043.9	1129.1	1284.7	866.3	791	807.1	882.4	1246.8	1014.8	864.7
29.Rayalaseema	645.3	769.4	891.7	893.9	571.5	818.6	579.5	759.6	1280.1	805.5
30.Tamil Nadu and Pondicherry	881.4	1086.5	1058.2	968.9	953.7	1170.7	952.5	864.9	1231.9	1205.1
31.Coastal Karnataka	3158.4	3482.8$	3953	3798.5	3780.8	3431.2	4360.1	3663.5	3121.5	4144.6
32.North Interior Karnataka	584.1	954.1$	750.3	855.9	724.6	810.8	701.2	646.5	883.4	750.8
33.South Interior Karnataka	875.6	787.5$	744.4	1149.7	1325.8	1171.9	1319.6	1024.9	1231.2	1265.8
34.Kerala	2073	3037.6$	2364.2	2836.6	3294.1	2816.1	3431.4	2888.6	2683.6	3213.9
35.Lakshadweep	1492.0$	1539.7$	1324.9	1610.6	1581.8	1473.3	1566.8	1747.6	1603.1	1764.3

$ Figures are based on observatory data.

Notes: 1. Data for the year 1986 onwards are based on observatory data.

2. For previous years' data i.e 1951 to 1971 which is according to old classification of sub-divisions

Source: India Meteorological Department,
Ministry of Science & Technology

TABLE 6.1.4: STATEWISE DISTRIBUTION OF NO. OF DISTRICT WITH EXCESS, NORMAL, DEFICIENT AND SCANTY RAINFALL FOR THE PERIOD FROM 1-6-98 TO 30-9-98

S.No.	State/UT	E	N	D	S	NR	**	TOTAL
1	Andhra Pradesh	13	10	--	--	--	--	23
2	Arunachal Pradesh	3	1	--	--	--	1	5
3	Assam	6	5	2	1	--	2	16
4	Bihar	12	18	7	--	--	2	39
5	Goa	--	1	--	--	--	--	1
6	Gujarat	6	12	1	--	--	--	19
7	Haryana	12	4	--	--	--	--	16
8	Himachal Pradesh	2	6	4	--	--	--	12
9	Jammu & Kashmir	1	3	3	1	--	4	12
10	Karnataka	19	8	--	--	--	--	27
11	Kerala	1	11	2	--	--	--	14
12	Madhya Pradesh	7	17	21	--	--	--	45
13	Maharashtra	15	13	2	--	--	--	30
14	Manipur	--	1	--	--	--	--	1
15	Meghalaya	--	2	--	--	--	--	2
16	Mizoram	--	--	1	--	--	--	1
17	Nagaland	--	--	1	--	--	--	1
18	Orissa	--	5	8	--	--	--	13
19	Punjab	6	2	3	--	--	1	12
20	Rajasthan	10	13	7	--	--	--	30
21	Sikkim	--	1	--	--	--	--	1
22	Tamil Nadu	8	9	5	--	--	--	22
23	Tripura	--	1	--	--	--	--	1
24	Uttar Pradesh	24	30	2	--	--	--	56
25	West Bengal	6	7	3	--	--	--	16
26	Andaman & Nicobar Island		1	--	--	--	--	1
27	Chandigarh	1	--	--	--	--	--	1
28	Dadra & Nagar Haveli & Daman	--	1	--	--	--	--	1
29	Diu	--	--	1	--	--	--	1
30	Delhi	1	--	--	--	--	--	1
31	Lakshadweep	1	--	--	--	--	--	1
32	Pondicherry	--	1	--	--	--	--	1

Legend :

E : Excess
N : Normal
D : Deficient
S : Scanty
NR : No Rain
** : Data Inadequate

Source : Monsoon 1998, End of the Season Report, India Meteorological Department.

TABLE 6.1.5: LIST OF DISTRICTS WITH DEFICIENT OR SCANTY RAINFALL DURING THE PERIOD JUNE 1 TO SEPTEMBER 30, 1998

State	Districts
Assam	1. Jorhat 2. Karbi-Anglong 3. Dhubri
Punjab	1. Amritsar 2. Faridkot 3. Sangrur
Mizoram	1. Mizoram
Himachal Pradesh	1. Chamba 2. Kangra 3. Sirmaur 4. Solan
Nagaland	1. Nagaland
Gujarat	1. Diu 2. Kutch
West Bengal	1. Bankura 2. Hoogly 3. Howrah
Jammu & Kashmir	1. Kupwara 2. Ladakh 3. Srinagar 4. Udhampur
Maharashtra	1. Bhandara 2. Nagpur
Orissa	1. Bolangir 2. Dhenkanal 3. Kalahandi 4. Keonjhargarh 5. Mayurbhanj 6. Phulbani 7. Sambalpur 8. Sundargarh
Tamilnadu	1. Chennai 2. Kanyakumari 3. South Arcot 4. Tirunelveli 5. Tiruvannamalai
Rajasthan	1. Bhilwara 2. Bundi 3. Jalore 4. Jhalawar 5. Kota 6. Pali 7. Sirohi
Bihar	1. Bhojpur 2. Gaya 3. Jahanabad 4. Lohardagga 5. Palamau 6. Singhbhumi 7. Vaishali
Uttar Pradesh	1. Pilibhit 2. Pithoragarh
Madhya Pradesh	1. Baster 2. Chhatarpur 3. Damoh 4. Durg 5. Guna 6. Hoshangabad 7. Jabalpur 8. Mandla 9. Narsingpur 10. Panna 11. Raigarh 12. Raipur 13. Rajgarh 14. Rajnandgaon 15. Rewa 16. Satna 17. Sehore 18. Seoni 19. Shadol 20. Shivpuri 21. Sidhi
Kerala	1. Thiruvananthapuram 2. Wynad

Source : Monsoon 1998, End of the Season Report, India Meteorological Department.

TABLE 6.1.6 : WATER FLOW IN STREAMS FOR THE YEAR 1993-94

Unit: Cusec

Name of Basin / River	Name of Guage Station		No. of CWC Sites	Maximum Flow		Minimum Flow	
	First site	Last site		First site	Last site	First site	Last site
Mahi	Mataji	Khanpur	6	1779.00	8391.00	0.000	5.800
Tapi	Dedtalai	Ghala	12	5802.00	1070.00	0.120	13.260
Narmada	Dindori	Gurudeshwar	19	1059.00	15976.00	0.300	25.500
Godavari	Chass	Polavaram	53	1139.00	18239.00	0.000	79.870
Cauvery	Kudige	Musiri	16	942.00	6400.00	2.301	2.102
Krishna	Karad	Vijaywada	56	1812.00	8724.00	0.692	26.560
Mahanadi	Rajim	Tikarpara	20	1577.00	16079.00	0.000	226.000
Subarnarekha	Muri	Ghatsila	4	79.83	1665.00	0.420	3.400

Source : Central Water Commission

TABLE 6.1.7: STATEWISE DETAILS OF INLAND WATER RESOURCES OF VARIOUS TYPES, 1993

(lakh hectares)

S. No.	State/UT	Rivers & Canals (Length in Kms.)	Reservoir	Tanks, Lakes & Ponds	Beels, Oxbow, Lakes & Derelict Water	Brackish Water	Total Water Bodies
1	Andhra Pradesh	11514	2.34	5.17	----	0.64	8.15
2	Arunachal	2000	----	0.01	0.03	----	0.04
3	Assam	1820	0.55	0.21	1.10	----	1.86
4	Bihar	3200	0.60	0.95	0.05	----	1.60
5	Goa	250	0.03	0.03	----	----	0.06
6	Gujarat	3865	2.43	0.71	----	0.95	4.09
7	Haryana	5000	Neg.	0.10	0.10	----	0.20
8	Himachal Pradesh	3000	0.40	0.01	----	----	0.41
9	Jammu & Kashmir	27781	0.07	0.17	0.06	----	0.30
10	Karnataka	9000	2.11	3.52	----	0.08	5.71
11	Kerala	3092	0.30	0.03	2.43	2.43	5.19
12	Madhya Pradesh	20661	2.91	1.17	----	----	4.08
13	Maharashtra	3200	2.79	0.32	----	0.10	3.21
14	Manipur	3360	0.01	0.05	0.40	----	0.46
15	Meghalaya	5600	0.08	0.02	Neg.	----	0.10
16	Mizoram	1743	----	0.02	----	----	0.02
17	Nagaland	1600	0.17	0.50	Neg.	----	0.67
18	Orissa	4500	2.56	0.64	1.80	4.33	9.33
19	Punjab	15270	Neg.	0.07	----	----	0.07
20	Rajasthan	N.A.	1.20	1.80	----	----	3.00
21	Sikkim	900	----	----	0.03	----	0.03
22	Tamil Nadu	7420	0.53	2.24	5.24	0.56	8.57
23	Tripura	1200	0.05	0.12	----	----	0.17
24	Uttar Pradesh	31200	1.50	1.62	1.33	----	4.45
25	West Bengal(P)	2526	0.17	2.76	0.42	2.10	5.45
26	Andaman & Nicobar Island	115	0.01	0.30	----	1.15	1.46
27	Chandigarh	2	----	Neg.	Neg.	----	0.00
28	Dadra & Nagar Haveli	54	0.05	----	----	----	0.05
29	Daman & Diu	12	----	----	----	----	0.00
30	Delhi	150	0.04	----	----	----	0.04
31	Lakshadweep		----	----	----	----	0.00
32	Pondicherry	247	----	Neg.	0.01	0.01	0.02
	Total	170282	20.90	22.54	13.00	12.35	68.79

N.A. : Not Available
(P) : Provisional
Neg. : Negligible

Source : Fishries Division, Department of Agriculture & Cooperation, Ministry of Agriculture

TABLE 6.1.8 : TOTAL LENGTH OF IMPORTANT RIVERS - BY STATE

S. No.	State	River	Total Length
1.	Andhra Pradesh (a)	Total	1554
		Godaveri	757
		Krishna	386
		Others	411
2.	Assam (c)	Total	3884
		Brahmputra	724
		Buridhing	161
		Disang	129
		Gangadhar	113
		Subansiri	143
		Kapali	103
		Kolodeye	112
		Kolong	121
		Katakhal	161
		Paanchar	105
		Others	2012
3.	Bihar (d)	Total	4403
		Ganga	631
		Gandak	300
		Koshi	236
		Ghagra	100
		Sone	226
		Damodhar	200
		Others	2710
4.	Gujarat (c)	Total	2005
		Narmada	230
		Tapti	200
		Others	1575 (a)
5.	Karnataka (c)	Total	1983
		Cauvery	270
		Tungabhadra	375
		Krishna	375
		Malaprabha	230
		Sharavathi	250
		Others	483
6.	Orissa (c)	Total	N.A.
		Mahanadi	493
		Brahmani	541
		Others	N.A.
7.	Tamil Nadu (c)	Total	2395
		Cauvery	416
		Cheyyar	157
		Palar	295
		Ponniyar	320
		Others	1207
8.	Kerala (b)	Total	3092
9.	West Bengal (b)	Total	3788
		Hooghly - Bhagirathi	409
		Sankosh	77
		Mahananda	206
		Ajoy	174
		Jalangi	232
		Others	2690
10.	Goa (b)	Total	526

Notes : (a) Figures relate to the year 1989-90
(b) Figures relate to the year 1991-92
(c) Figures relate to the year 1993-94
(d) Figures relate to the year 1994-95

Source : Transport Research Division. Ministry of Surface Transport

TABLE 6.1.9: GROUND WATER RESOURCE POTENTIAL AS PER BASINS (PRORATA BASIS)

S.No.	BASIN	Total Replenishable Ground Water Resourse (M.C.M)	Provision for domestic Industrial & Other Uses (M.C.M)	Available for Irrigation (M.C.M)	Net Draft (M.C.M)	Balance for Future use (M.C.M)	% Level of G.W. Develop -ment
1	Brahmaputra basin	26545.69	3981.35	22564.34	760.06	21804.29	3.37
2	Brahmani with Baitarni	4054.23	608.13	3446.09	291.22	3154.88	8.45
3	Cambai composite	7187.25	1078.09	6109.16	2449.06	3660.10	40.09
4	Caveri basin	12295.71	1844.35	10451.35	5782.85	4668.50	55.33
5	Ganga basin	170994.74	26030.47	144964.26	48593.67	96370.56	33.52
6	Godavari basin	40649.82	9657.69	30992.12	6054.23	24937.90	19.53
7	Indus basin	26485.42	3053.95	23431.47	18209.30	5222.17	77.71
8	Krisnhna basin	26406.97	5578.34	20828.63	6330.45	14498.19	30.39
9	Kutch & saurashtra	11225.09	1738.10	9486.99	4851.87	4791.02	51.14
10	Madras & Southern Tamilnadu	18219.72	2732.95	15486.77	8933.25	6553.52	57.68
11	Mahanadi basin	16460.55	2471.10	13989.45	972.63	13016.81	6.95
12	Meghna basin	8516.69	1277.48	7239.21	285.34	6953.87	3.94
13	Narmada basin	10826.54	1653.75	9172.79	1994.16	7178.61	21.74
14	Northeast compos	18842.61	2826.39	16016.22	2754.93	13261.29	17.20
15	Pennar basin	4929.29	739.39	4189.89	1533.38	2656.51	36.60
16	Subranarekha basin	1819.41	272.91	1546.50	148.06	1398.43	9.57
17	Tapi basin	8269.50	2335.79	5933.70	1961.33	3972.38	33.05
18	Western Ghat basin	17693.72	3194.78	14499.18	3318.12	11181.06	22.88
Total		431422.95	71075.01	360348.12	115223.91	245280.09	31.92

Source: Ground Water Statistics 1996, Central Ground Water Board

Out of the total water withdrawn from various sources, 97% is used for agriculture and livestock, the rest being accounted by withdrawal for domestic consumption, industrial use and power generation. However, not all the water abstracted is effectively used, there are sizeable losses in conveyance and application of irrigated water, a large part of water used by industry and domestic purposes is returned to the streams as effluent waste; and most of the water drawn by power station is used for cooling purposes and is available for reuse.

The water pollution in India comes from three main sources : domestic sewage, industrial effluents and run off from activities such as agriculture. Major industrial sources of pollution in India include the fertilizer plants, refineries, pulp and paper mills, leather tanneries, metal plating and other chemical industries.

TABLE 6.1.10 : GROUND WATER RESOURCES OF INDIA STATEWISE

S.No.	State/UT's	Total Replenishable Ground Water Resource (MCM/Yr)	Provision for Domestic Industrial and other uses (MCM/Yr)	Available Ground water for irrigation resource in net terms (MCM/Yr)	Net Draft (1993) (MCM/Yr)	Balance Ground water resources for future use (MCM/Yr)	Level of ground water develop-ment' (%)	Utilisable irrigation potential for land develop-ment (Mha)
1	Andhra Pradesh	35291.64	5293.75	29997.89	7092.26	22905.63	23.64	3.96008
2	Arunachal Pradesh	1438.50	215.78	1222.73		1222.73	0.00	0.01800
3	Assam	24719.24	3707.89	21011.35	942.04	20069.31	4.48	0.90000
4	Bihar	33521.66	5028.25	28493.41	5467.43	23025.98	19.19	4.94763
5	Goa	218.24	32.74	185.50	15.40	170.10	8.30	0.02929
6	Gujarat	20376.47	3056.47	17320.00	7170.08	10149.92	41.40	2.75589
7	Haryana	8527.51	1279.13	7248.38	6079.69	1168.69	83.88	1.46170
8	Himachal Pradesh	365.81	73.16	292.65	52.80	239.85	18.04	0.06850
9	Jammu & Kashmir	4425.84	663.88	3761.96	50.02	3711.94	1.33	0.70795
10	Karnataka	16185.88	2427.88	13758.00	4301.00	9457.00	31.26	2.57281
11	Kerala	7900.28	1313.48	6586.80	1006.22	5580.58	15.28	0.87925
12	Madhya Pradesh	50889.26	7633.39	43255.87	7130.81	36125.06	16.49	9.73249
13	Maharashtra	37867.32	12397.00	25470.32	7740.09	17730.23	30.39	3.65197
14	Manipur	3154.00	473.00	2681.00	0.00	2681.00	Neg.	0.36900
15	Meghalaya	539.66	80.95	458.71	18.20	440.51	Neg.	0.06351
16	Mizoram	0.00	0.00	0.00	0.00	0.00		
17	Nagaland	724.00	109.00	615.00	0.00	615.00	Neg	
18	Orissa	20001.33	3000.20	17001.13	1431.09	15570.04	8.42	4.20258
19	Punjab	18654.90	1865.50	16789.50	15757.70	1031.80	93.85	2.91715
20	Rajasthan	12707.60	1994.54	10713.06	5423.67	5289.39	50.63	1.77783
21	Sikkim	0.00	0.00	0.00	0.00	0.00		
22	Tamil Nadu	26391.24	3958.69	22432.55	13557.71	8874.84	60.44	2.83206
23	Tripura	663.41	99.51	563.90	188.50	375.40	33.43	0.08056
24	Uttar Pradesh	83820.85	12573.13	71247.72	26835.28	44412.44	37.66	16.79896
25	West Bengal	23092.32	3463.85	19628.47	4745.38	14883.09	24.18	3.31794
26	Andaman & Nicobar Island	0.00	0.00	0.00	0.00	0.00		
27	Chandigarh	29.66	0.00	0.00	24.54	5.12		
28	Dadra & Nagar Haveli	42.20	6.33	35.87	4.57	31.30	12.74	0.00504
29	Daman & Diu	13.00	2.00	11.00	9.00	2.00		
30	Delhi	291.64	178.42	0	118.00	0.00		
31	Lakshadweep	2.43	0.00	2.43	1.55	0.88	63.79	
32	Pondicherry	28.77	4.32	24.45	5.95	18.50	24.34	
	Total	431884.66	70932.24	360809.65	115168.98	245788.33	31.92	64.05019

Source: Ground Water Statistics 1996, Central Ground Water Board
MCM : Million hectare metres.

For resources available to meet the needs, it is useful to distinguish between (a) total volume of water resources from surface flow and ground water recharge available in a year ; (b) the volumes which are considered to be utilizable; (c) actual utilization.

The estimates of surface flows continue to be based largely on empirical formulae relating rainfall to surface runoff. The lack of data based on measurement of actual flow in the main river and tributaries of different river systems over sufficiently long periods (30-40 years observations are considered to be reasonable basis) remains one of the most serious handicaps in the planning of water resources development. The states have their own gauges, but since many rivers are the subject of inter-state disputes they are unwilling to provide the data on observed flows.

TABLE 6.1.11 : ANNUAL REQUIREMENT OF FRESH WATER

(Unit : Cubic Km.)

S. No.	Different uses of water	2000 AD		2025 AD	
		Surface Water	Ground Water	Surface Water	Ground Water
1.	Irrigation	420.00	210.00	510.00	260.00
2.	Other Uses	80.00	40.00	190.00	90.00
I	Domestic and Live Stock *	32.85		46.00	
II	Industries *	30.00		120.00	
III	Thermal Power *	3.30		4.00	
IV	Misc. *	53.85		110.00	

* : Approximate from both source where applicable

Source : Central Water Commission (W.M. Directorate)

TABLE 6.1.12 : CATCHMENT AREA OF MAJOR RIVER BASINS

S.No.	Name of the River	Origin	Length (Km.)	Catchment area (Sq.Km.)
1	Indus	Mansarover (Tibet)	1114*	321289*
2	a) Ganga	Gangotri (Uttarkashi)	2525*	861452*
	b)Brahmaputra	Kailash Range (Tibet)	916*	194413*
	c) Barajk & other rivers flowing into Meghna like Gomti, Muhari,Fenny etc.			41723
3	Sabarmati	Aravalli Hills (Rajasthan)	371	21674
4	Mahi	Dhar (Madhya Pradesh)	583	34842
5	Narmada	Amarkantak (Madhya Pradesh)	1312	98796
6	Tapi	Betul (Madhya Pradesh)	724	65145
7	Brahmani	Ranchi (Bihar)	799	39033
8	Mahanadi	Nazri Town (Madhya Pradesh)	851	141589
9	Godavari	Nasik (Maharashtra)	1465	312812
10	Krishna	Mahabaleshwar (Maharashtra)	1401	258948
11	Pennar	Kolar (Karnataka)	597	55213
12	Cauvery	Coorg (Karnataka)	800	81155
Total				2528084

Source: Central Water Commission, Reassessment of Water Resources Potential of India,1993

* : As in Indian Territory

TABLE 6.1.13 : PRIMARY WATER QUALITY CRITERIA

Designated Best Use	Class of Water	Criteria
Drinking water source without Conventional treatment but after disinfection	A	1 Total coliforms Organised MPN/100ml shall be 50 or less 2 pH between 6.5 & 8.5 3 Dissolved Oxygen 6mg/l or more 4 Biochemical Oxygen Demand 5 days 20°C 2mg/l or less.
Outdoor bathing (organised)	B	1 Total coliforms Organism MPN/100ml shall be 500 or less 2 pH between 6.5 & 8.5 3 Dissolved Oxygen 5mg/l or more 4 Biochemical Oxygen Demand 5 days 20°C 3mg/l or less.
Drinking Water Source	C	1 Total coliforms Organism MPN/100ml shall be 5000 or less 2 pH between 6 & 9 3 Dissolved Oxygen 4mg/l or more 4 Biochemical Oxygen Demand 5 days 20°C 3mg/l or less.
Propagation of Wild life	D	1 pH between 6.5 & 8.5 Fisheries 2 Dissolved Oxygen 4mg/l or more 3 Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial cooling, Controlled Waste	E	1 pH between 6.0 or 8.5 2 Electrical conductivity at 25°C micro mhos/cm Max 2250. 3 Sodium absorption Ratio, Max 26 4 Boron, Max 2mg/l

Source : Water Quality - Status & Statistics (1993 & 1994)
Central Pollution Control Board

The water quality at any location is determined as the one which is satisfied at least 80% of time by all the criteria parameters. To further elucidate on this as if at a location 80% of the time DO, pH were in the range specified for class A, BOD for class B and total coliforms for class C, then the existing status is determined as C.

TABLE 6.1.14 : MINIMUM & MAXIMUM OF OBSEVED VALUES OF WATER QUALITY PARAMETERS AT CWC SITES ON WEST FLOWING RIVERS (JUNE 1991 TO MAY 1992)

S. No.	Name of the Site	Name of the River/ Stream	pH Value		Specific Conductance in micromhos/cm at 25 ^{0}C		Sodium Absorption Ratio (%/cm)		Cl	SO_4	NO_3	Fe	Mg	SP Max.	RSC Max.	Total Hardness
			Min.	Max.	Min.	Max.	Min.	Max.	Maximum (me/l)							
1	Gadat	Ambika	7.50	8.20	216	467	0.54	1.27	0.85	0.43	0.00	0.02	0.80	120.10	0.23	36.36
2	Kamalpur	Banas	----	----	----	----	----	----	----	----	----	----	----	----	----	----
3	Ganod	Bhadar	7.20	8.00	317	501	1.37	2.66	1.92	0.55	0.01	0.01	0.80	119.90	0.24	53.20
4	Mataji	Mahi	7.40	8.20	256	554	0.44	0.96	0.96	0.41	0.01	0.01	0.80	127.95	0.22	33.81
5	Padardibadi	Mahi	7.40	8.20	345	578	0.60	1.88	1.01	0.54	0.01	0.02	0.88	127.95	0.43	47.30
6	Kadana	Mahi	7.60	8.20	242	380	0.54	1.09	0.90	0.26	0.01	0.02	0.64	108.00	0.42	35.85
7	Khanpur	Mahi	7.40	8.40	286	913	0.53	2.26	1.80	0.93	0.01	0.03	0.96	151.95	0.35	47.39
8	Manot	Narmada	7.30	8.30	120	325	0.16	0.55	0.68	0.46	0.05	0.00	1.64	155.70	1.53	18.75
9	Jamtara	Narmada	7.50	8.60	123	218	0.13	0.35	0.28	0.15	0.02	0.00	0.76	102.05	0.91	17.95
10	Burman Ghat	Narmada	7.60	8.70	154	308	0.22	1.71	0.39	0.15	0.07	0.00	1.37	133.75	1.00	45.59
11	Gadarwara	Suckkar	7.60	8.70	144	500	0.15	0.77	0.39	0.18	0.05	0.00	3.28	235.85	3.51	25.56
12	Sandia	Narmada	7.80	8.60	221	436	0.28	0.85	0.42	0.47	0.04	0.00	1.56	193.90	3.36	28.00
13	Hoshangabad	Narmada	7.10	8.90	154	364	0.25	1.06	0.39	0.16	0.03	0.00	1.56	181.90	1.61	28.15
14	Handia	Narmada	7.60	8.70	154	384	0.24	0.96	0.39	0.16	0.03	0.00	1.76	171.65	2.63	37.76
15	Gonnore	Narmada	7.70	8.70	192	433	0.22	1.08	0.65	0.20	0.06	0.00	2.04	179.07	2.89	33.55
16	Mandleshwar	Narmada	7.20	8.20	114	400	0.38	0.96	0.45	0.21	0.04	0.00	1.44	145.80	2.36	34.30
17	Rajghat	Narmada	7.60	8.20	154	523	0.21	1.29	1.58	0.63	0.05	0.00	1.72	165.80	1.75	33.44
18	Garudeshwar	Narmada	7.40	8.20	224	725	0.44	1.51	0.96	0.36	0.00	0.04	0.92	134.05	0.52	40.27
19	Chandwada	Purna	7.40	8.20	215	383	0.70	1.15	0.73	0.50	0.00	0.02	0.81	128.35	0.33	34.68
20	Mahuwa	Sabarmati	7.40	8.20	211	508	0.43	1.51	1.13	0.30	0.00	0.03	0.92	134.20	0.41	41.44
21	Valasana	Shetrunji	7.40	7.80	288	840	0.49	1.76	1.24	0.74	0.01	0.03	1.04	155.85	0.59	42.82
22	Lowara	Tapi	7.40	8.20	466	7333	2.82	19.41	34.82	5.79	0.01	0.05	4.00	596.55	3.99	78.80
23	Burhanpur	Tapi	7.40	8.20	246	933	0.44	4.08	2.48	0.71	0.01	0.07	1.04	142.20	1.29	64.15
24	Yerli	Tapi	7.40	8.10	278	1239	0.84	4.76	3.04	0.92	0.00	0.04	1.03	155.30	1.42	66.31
25	Dhapuri	Tapi	7.40	8.20	233	466	0.36	1.19	0.90	0.62	0.00	0.03	0.90	128.80	0.12	36.62
26	Savkheda	Tapi	7.40	8.20	225	590	0.54	1.64	1.01	0.46	0.00	0.03	0.90	136.80	0.84	37.97
27	Sarangkheda	Tapi	7.40	8.20	246	645	0.82	2.27	1.18	0.95	0.01	0.03	0.80	131.95	0.51	49.95
28	Ghala	Tapti	7.40	8.20	267	432	0.49	1.04	0.68	0.36	0.01	0.02	0.80	123.95	0.36	34.90
29	Durvesh	Vaitarna	7.40	8.20	220	305	0.35	0.78	0.45	0.20	0.00	0.03	0.72	104.00	0.29	26.98

Remarks :

pH :The logarithm to the base 10 of the reciprocal of Hydrogen ion concentration

Cl : Chlorine SO_4 : Sulphate NO_3 : Nitrate Fe : Iron Mg : Magnesium

SP : Sodium Percentage RSC : Residual Sodium Carbonate me/l : Milli equivalent per litre

Source : Central Water Commission (Statistics Directorate)

TABLE 6.1.15 : MINIMUM & MAXIMUM OF OBSERVED VALUES OF WATER QUALITY PARAMETERS AT CWC SITES ON EAST FLOWING RIVERS (JUNE 1992 TO MAY 1993)

S. No.	Name of the Site	Name of the River/ Stream	pH Value		Specific Conductance in micromhos/cm at		Sodium Absorption Ratio (%/cm)		Cl	SO_4	NO_3	Fe	Mg	SP Max.	RSC Max.	Total Hardness
			Min.	Max.	Min.	Max.	Min.	Max.	Maximum (me/l)							
1	Tikarapara	Mahanadi	7.40	8.20	165	410	0.27	0.46	0.88	0.34	0.83	0.02	1.20	80.06	0.34	24.29
2	Kantamal	Tel	6.88	8.39	134	224	0.42	0.93	0.26	0.19	0.04	0.00	0.85	102.58	0.29	32.9
3	Salebhata	Ong	7.16	8.38	158	339	0.57	1.56	0.4	0.25	0.04	0.00	1.00	145.12	1.21	43.7
4	Sundergarh	Ib	7.19	8.19	95	224	0.37	0.87	0.31	0.08	0.04	0.00	0.6	74.56	0.60	33.1
5	Kurubhanta	Mand	7.24	8.56	91	159	0.2	0.59	0.21	0.10	0.06	0.00	0.5	66.55	0.20	30.7
6	Basantpur	Mahanadi	7.4	8.18	129	294	0.37	1.06	0.69	0.90	0.11	0.06	0.8	100.08	0.41	33.5
7	Bamnidhi	Masdeo	7.28	8.03	96	252	0.26	1.37	0.55	0.43	0.05	0.04	0.8	92.08	0.78	49.3
8	Rampur	Jonk	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	Jondhra	Seonath	7.44	8.68	174	463	74.56	1.2	0.56	0.62	0.06	0	1.39	149.62	0.52	32.2
10	Andhiyarkora	Hamp	7.7	8.05	238	838	0.51	2.72	0.43	2.32	0.07	0	2.4	250.2	1.6	45.7
11	Simga	Seonath	7.5	8.22	153	497	0.27	1.18	1.17	0.51	0.06	0	1.4	180.15	0.61	29.9
12	Rajim	Mahanadi	7.53	8.07	77	208	0.29	0.39	0.28	0.12	0.08	0	0.4	100.08	0.15	19.3
13	Baronda	Pairi	6.59	8.57	69	130	0.16	0.33	0.35	0.06	0.03	0.07	0.45	63.55	0.1	18.8
14	Jenapur	Brahmani	7.73	8.4	115	182	0.33	0.54	0.27	0.19	0.2	0.03	0.56	80.06	0.23	25.5
15	Telechar	Brahmani	7.2	8.23	84	156	0.31	0.46	0.27	0.22	0.1	0.07	0.48	64.05	0.3	25.2
16	Gomlai	Brahmani	7.59	7.96	80	218	0.33	0.71	0.39	0.42	0.41	0.02	0.81	91.42	0.09	29.2
17	Jaraikela	Koel	7.52	8.7	53	227	0.33	0.43	0.38	0.12	0.06	0.04	0.96	112.09	0.3	25.1
18	Anandpur	Baitarni	7.46	8.5	110	194	0.29	0.48	0.33	0.15	0.08	0.07	0.48	72.06	0.26	25.9
19	Ghatsila	Subaranrel	6.32	7.86	130	1127	0.45	1.72	2.14	3.79	0.95	0.03	2.8	340.28	0.09	37.5
20	Jamshedpur	Subaranrel	7.5	8.49	177	450	0.51	1.6	1.44	0.75	0.19	0.02	1.36	152.12	0.36	38.5
21	Adityapur	Karkai	7.7	8.41	191	485	0.51	1.36	1.04	0.36	0.31	0.04	1.44	152.12	0.5	36.3
22	muri	Subaranrel	7.57	8.54	183	421	0.61	1.15	0.77	0.72	0.19	0.04	1.6	168.14	0.47	41.4
23	Kashinagar	Vamsadha	6.94	8.1	117	428	0.26	1.45	0.55	0.52	0.06	0.02	1.44	168.14	1.19	38.5
24	Tilga	Sankh	7.02	8.4	51	123	0.31	0.56	0.22	0.16	0.09	0.04	0.32	47.44	0.3	31.6
25	Bolani	Brahmani	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Remarks :

pH :The logarithm to the base 10 of the reciprocal of Hydrogen ion concentration

Cl : Chlorine SO_4 : Sulphate NO_3 : Nitrate Fe : Iron Mg : Magnesium

SP : Sodium Percentage RSC : Residual Sodium Carbonate me/l : Milli equivalent per litre

Source : Central Water Commission (Statistics Directorate)

TABLE 6.1.16 : RIVER-WISE DISTRIBUTION OF MONITORING STATIONS

Name of River	Tributaries and Sub-Tributaries	No. of Monitoring Sites		
		Main Stream	Tributaries	Total
Brahmani	Karo, Koel, Sankh	11	5	16
Baitrani		5		5
Brahmputra	Dhansiri, Disang, Burhidihing, Gumti, Jhanji, Subansiri	5	7	12
Cauvery	Arkavathi, Bhavani, Kabbani, Lakshmantirtha, Amravati	20	15	35
Ganga	Barakar, Damodar, Gandak, Ghaghra, Kshipra, Kalinadi, Mandakini, Ramganga, Rihand, Rupanarayan, Saryu, Sai, Son, Gomati, Tons, Yamuna, Betwa, Banas, Chambal, Hindon, Khan	27	56	83
Godavari	Indravati, Kalu, Manjera, Maner, Panchganga, Ulhas, Wainganga, Wardha, Pench	11	12	23
Indus	Beas, Chenab, Jhelum, Largi, Parvati, Ravi, Satluj, Tawi		41	41
Krishna	Bhandra, Bhima, Dindi, Nira, Ghatprabha, Hemawati, Malprabha, Muneru, Musi, Palleru, Tungha, Tungha-bhadra	14	27	41
Mahi	Anas, Panam	7	2	9
Mahanadi	Ib, Kathijoda, Kharoon, Kaukhai, Hasdeo, Tel, Seonath	15	12	27
Narmada	Chota Tawa	14	1	15
Sabarmati	Hathmati, Meshwa	8	2	10
Tapi	Girna	11	2	13
Penner		4		4
Subernarekha		4		4
West Flowing Medium Rivers	Ambika, Bhadar, Kali, Mandovi Pamba, Periyar	10		10
East Flowing Medium Rivers	Vaigai, Nagavalli, Palar, Rushikulya, Tambiraparani	12		12
Minor Rivers	Achankoli, Chalakudy, Damanganga, Ghaggar, Kallad, Manimala, Mindhola, Par, Borak, Iril, Imphal, Kharkhla, Umtrew, Khari, Kolak, Bhatsa, Kundalika, Patalganga, Zuari, Chaliyar, Karmana, Mauthupuzha, Meenachil, Amlakhadi, Vamanpuram	40		40

Source : Water Quality - Status & Statistics (1993 & 1994)
Central Pollution Control Board

The Central Pollution Control Board (CPCB) in collaboration with the State Pollution Control Boards (SPCBs) has established the Water Quality Monitoring (WQM) network of 480 stations spread over 21 States and 4 Union Territories, in the country. The WQM network covers 126 rivers (including tributaries), 24 wells, 34 lakes, 3 creeks, 2 ponds, 2 tanks, 3 drains and 2 canals.

Monitoring of the rivers Ghaggar, Baitarni, Beas, Satluj, Tawi, Jhelum, Parvati, Ravi, Largi, Chenab, Yamuna, Sone, Tons, Imphal, Western Yamuna Canal, Lakes and some wells are conducted on a quarterly basis and at all other locations on a monthly basis.

TABLE 6.1.17 : ANNUAL INTERNAL RENEWABLE WATER RESOURCES & WATER WITHDRAWALS IN SELECTED COUNTRIES OF WORLD

Country	Annual Internal Renewable Water Resources[a]		Annual Withdrawals			Sectoral Withdrawals (Percent)		
	Total (Cubic Kilometres)	1995 Per Capita (Cubic Metres)	Year of Data	% of Water Resources[a]	Per Capita (Cubic Metres)	Domestic	Industry	Agriculture
Egypt	58.1	923	1992	97	956	6 [b1]	9	85
Kenya	30.2	1069	1990	7	87	20 [b1]	4	76
Nigeria	280.0	2506	1987	1	41	31 [b1]	15	54
Bhutan	95.0	57998	1987	0	14	36 [b]	10	54
China	2800.0	2292	1980	16	461	6 [b]	7	87
India	2085.0	2228	1975	18	612	3 [b]	4	93
Indonesia	2530.0	12804	1987	1	96	13 [b]	11	76
Iran	117.5	1746	1975	39	1362	4 [b]	9	87
Japan	547.0	4373	1990	17	735	17 [b]	33	50
Korea, Rep.	66.1	1469	1992	42	632	19 [b]	35	46
Italy	167.0	2920	1990	34	986	14 [b1]	27	59
Russian Federation	4498.0	30599	1991	3	790	17 [b1]	60	23
United Kingdom	71.0	1219	1991[c]	17	205	20 [b1]	77	3
Argentina	994.0	28739	1976	4	1043	9 [b]	18	73
Brazil	6950.0	42957	1990	1	246	22 [b]	19	59
Mexico	357.4	3815	1991[c]	22	899	6 [b]	8	86
Canada	2901.0	98462	1991[c]	2	1602	18 [b]	70 [b]	12 [b]
United States	2478.0	9413	1990	19	1870	13 [b1]	45 [b1]	42 [b1]

Source: Global Environment Outlook, 1997, United Nations Environment Programme

Notes :

a : Annual Internal Renewable water Resources usually include river flows from other countries.

b : Sectoral withdrawl percentages are estimated for 1987.

b1 : Sectoral percentages date from the year of other annual withdrawl data.

c : Data are from early 1990s.

TABLE 6.2.1: LENGTH OF COASTLINE AND POPULATION OF COASTAL STATES AND ISLANDS

S.No.	Name of State/ Union Territories	Length of Coastline (Km.)	Area(Thousand Sq. Km.)	Population 1991 (000000)
1	Gujarat	1600	196.00	41.20
2	Maharashtra	840	307.70	78.70
3	Goa	300	3.70	1.20
4	Karnataka	400	191.80	44.80
5	West Bengal	950	88.70	68.00
6	Tamil Nadu	720	130.10	55.60
7	Orissa	560	155.70	31.50
8	Kerala	1014	39.00	29.00
9	Andhra Pradesh	960	275.00	66.30
10	Andaman & Nicobar Islands	--	8.50	0.30
11	Lakshadweep	--	0.03	0.05

Source : State of The Environment

India has a coastline of about 7515 Km., its peninsular shape jutting into the Indian Ocean. The major portion of the west coast is dominated by a scarped slope resulting in a well-drained, flood free hinterland. In the Gujarat area, the coastal zone is marked by low land, free from rocky terrain. The east coast is flatter and wider and tends to be better cultivated and more densely populated than the west coast.

The Indian coastline can be divided into the Gujarat region, the West Coast, the East Coast and the Islands. Gujarat region is made up of Kutch and Kathiawar peninsular to the west, separated by the Gulf of Kutch. This is a region of mudflats while the east, the Khambat region is made up estuaries and rias. The West Coast is made up of the Konkan Coast, the Karnataka Coast and the Malabar Coast. While north Konkan is low lying with sandy spits, the southern region is rugged and rocky. The Malabar Coast is characterized by sand dunes, backwaters and lagoons. The east-coast has extensive coastal plains and large deltas of the river Cauvery, Krishna, Godavari and Mahanadi. To the north lies the large delta of the Ganga and the Brahmaputra rivers. A number of sand dunes occur on this coast extending well inland.

The Lakshadweep group of islands are characterized by extensive coral reef system with lagoons and beach vegetation. The Andaman and Nicobar Islands are covered with dense forests from shore to the hills.

TABLE 6.2.2 : MAIN ACTIVITIES ALONG THE INDIAN COASTAL ZONE

	Land Based :	
I.	Coast dependent	Ports & Harbours Oil Terminals Paper & Pulp mills Metallurgical Plants Fish Processing Power Plants
II.	Coast prefering	Urban, commercial & residential development Tourism & beach recreation Agriculture
III.	Coast independent	Defence
	Water based	Offshore oil and gas Offshore placer mining Navigation Naval defence Water sports Fishing Dredging & Land Relclamation

Source : The State of Environment, 1995
Ministry of Environment & Forests

Coastal areas are of enormous socio-economic importance, because of both their traditional resources viz. fish, tourist potential, commercial and residential development as well as the new types of resources using new technologies such as ocean thermal energy, wave energy, offshore mineral deposits, mariculture etc. The high economic value of these areas and the relative fragility and vulnerability to natural hazards, sea level rise and anthropogenic activities make the preservation and the management of coastal zone resources and its environment of enormous importance.

TABLE 6.2.3 : INDUSTRIAL & SEWAGE DISCHARGES TO THE COASTAL WATERS

S.No.	State/Coast	Industrial Waste Water(MLD)
1	Gujarat	566
2	Maharashtra	80
3	Goa	12
4	Karnataka	43
5	Kerala	151
6	Tamil Nadu	378
7	Pondicherry	6
8	Andhra Pradesh	2466*
9	Orissa	1
10	West Bengal	22
	Total	**3725**

Source:Central Pollution Control Board

* : Including 2116 MLD from Aquaculture farms

TABLE 6.2.4:POLLUTANTS AND THEIR IMPACTS ON THE MARINE ENVIRONMENT

Sources	Impacts
Municipal and domestic waste	Reduce dissolved oxygen (DO); increase hydrogen sulphide levels; incidence of faecal coliform & faecal streptococci; high biological oxygen demand (BOD)
Industrial waste	affect DO, temprature, turbidity, pH, ammonia values; increases BOD, COD, suspended solids
Toxic metals	cause change in chemical and biochemical processes, increase in turbidity, lethal and sublethal effects on marine life
Oil pollution	causes smothering, clogging and toxicity
Fertilizers	affect nutrient levels and may cause eutrophication
Dredging & Reclamation	affect habitats of marine organisms; lethal and sublethal effects; affects flushing capacity of the waterbody
Siltation	increases in nutrient levels and can cause excessive algal bloom; may also cause damage to coral reefs and coastal nurseries
Discharge of coolant waters	raises the temprature of the water can cause the growth of the blue-green algae
Toxic chemicals	Cause lethal and sublethal effects on marine organisms
Offshore mining	increses particulate loading which can lead to loss of light and reduced primary productivity ; smothering and clogging of benthic communities
Radionuclides	bioaccumulation in fish and other benthic communities

Source : The State of Environment, 1995
Ministry of Environment & Forests

TABLE 6.2.5 : "POTENTIAL HOTSPOTS" ALONG THE INDIAN COAST

States	Coastal cities/ towns
Gujarat	Okha, Veraval
Maharashtra	Bassein, Bombay Harbour, Thane, Trombay, Versova, Ulhas creek, Mahim
Goa	Marmagoa
Karnataka	Karwar, Mangalore
Kerala	Kochin, Thiruvanthapuram
Tamil Nadu	Ennore, Madras Harbour, Cooum, Port Calimere, Koodankulam, Arumuganeri, Tuticorin
Andhra Pradesh	Vishakhapatnam
Orissa	Gopalpur, Paradip, Puri
West Bengal	Indo-Bangladesh border, Sandheads, Diamond Harbour

Source: State of the Environment, 1995

Pressures on the marine environment arise from both natural as well as anthropogenic activities. The latter occurs either due to overexploitation of coastal and marine resources or due to the use of the coastal and marine environment as sinks of pollutants and other wastes arising as by-products of development activities. There are various such sources of marine pollution, their impacts varying according to the nature of the coastal or marine environment impacted upon and on the nature of the pollutant itself.

Marine population occurs off most metropolitan cities and densely populated coastal towns in India, but there are 25 heavily polluted potential 'hot spots' along the Indian coast.

CHAPTER SEVEN

HUMAN SETTLEMENT

7.1 POPULATION & POVERTY

The root cause of environmental degradation in India can be attributed to rapid growth of population. India has approximately 18 per-cent of world population but only 2 per-cent of the geographical area. The application of medical knowledge and social care has lowered the death rate while the birth rate remains fairly constant. Dandekar has analysed the pattern of decline in the death rate and birth rate for the period 1972-78 and 1979-1990 and observed that the death rate was declined much greater during the second sub-period (1979-90) than in the first sub-period (1972-78). However, in contrast to the decline in the death rate, the decline in the birth rate during the second sub-period was much smaller than in the first sub-period. Due to this, poverty could not be eradicated inspite of the fact that poverty alleviation is on the national agenda for more than fifty years. In 1972 in the Stockholm conference on environment, the then Prime Minister of India Smt Indira Gandhi has said that poverty is a great pollutant. Twenty years later in 1992 World Bank stated that " poor are the agents and victims of environmental degradation". The poor become agents of environmental degradation when they are victims of it.

Human development is also adversely affected by the environmental degradation. Two of the environmental indicators viz. access to safe drinking water and sanitation are closely linked with two of the very important human development indicators viz. infant mortality and life expectancy. Polluted air and poor and unhygienic conditions increase the damages of reduced life expectancy and increased infant mortality. Life expectancy in India is still on very low ebb and infant mortality rate is much more than desirable. The poor therefore, take fertility decisions to compensate for these factors and to avoid risks. Larger population leads to more poverty and worsens the environment creating a vicious cycle.

7.2 HOUSING & BASIC SERVICES

We do not need food only but alongwith the food we also need potable water, adequate disposal of excreta, good sanitation and personal hygiene to reduce prevalence of morbidity. Several studies carried out in our villages confirm that diarrhoea and respiratory are the most common and dangerous diseases among children. The majority of illness tends to synergies malnutrition both by demanding higher energy intake to meet the rise in BMR which accompany fever and by requiring higher intake of protein and other nutrients to form antibodies for fight the illness. It is this negative

correlation which Japan used to formulate her policy in post war years to provide water for drinking, pit latrines to dispose of excreta, sanitation to control breeding of flies and mosquitoes which in turn resulted in increased life expectation of 12 years during the immediate post war decade (Extracts from P.V. Sukhatame letter dated 15-1-93).

7.3 URBANISATION

Environment has also been affected badly due to rapid growth of urbanisation. Urban population in India growing at an annual rate of 3.5% to 3.8% and our cities are today faced with multiple and complex environmental problems. Under population pressure the environment resource base of cities has depleted at a rapid rate. About one fifth of the urban population resides in slums and one third of the population has not even direct access to sanitation and safe drinking water. Which in turn results in poor health.

7.4 WASTE MATERIAL MANAGEMENT

Due to rapid growth of urbanization, there is substantial increase in generation of solid waste in both absolute and per capita terms. When this solid waste is not collected and disposed of efficiently and effectively, it attracts rodents and flies which then spread diseases. It also pollutes and degrades land and water resources. If these wastes are left untreated they would ferment slowly and would produce bio-gas which would be distributed in the atmosphere. The bio-gas contains 65-75% methane gas which is a green house gas having a global warming potential 34 times more than that of Carbon Dioxide. Therefore, development of suitable technologies for utilisation of wastes is essential to minimize adverse health and environment consequences.

TABLE 7.1.1 : POPULATION TOTALS - INDIA AND STATES

States/U.Ts.	1961		1971		1981	
	Male	Female	Male	Female	Male	Female
Andhra Pradesh	18161671	17821776	22008663	21494045	27109616	26441410
Arunachal Pradesh	177680	158878	251231	216280	339322	292517
Assam@	5798376	5038953	7714240	6910912	9444037	8597211
Bihar	23297343	23150114	28846944	27506425	35930560	33984174
Goa*	302534	324133	431214	426557	548450	538280
Gujarat	10633902	9999448	13802494	12894981	17552640	16533159
Haryana	4062787	3527737	5377044	4659387	6909679	6012440
Himachal Pradesh	1451334	1361129	1766957	1693477	2169931	2110887
Jammu & Kashmir	1896633	1664343	2458315	2158317	3164660	2822729
Karnataka	12040923	11545849	14971900	14327114	18922627	18213087
Kerala	8361927	8541788	10587851	10759524	12527767	12925913
Madhya Pradesh	16578204	15794204	21455334	20198785	26886305	25292539
Maharashtra	20428882	19124836	26116351	24295884	32414432	30368386
Manipur	387058	392979	541675	531078	721006	699947
Meghalaya	397288	372092	520967	490732	683710	652109
Mizoram	132465	133598	170824	161566	257239	236518
Nagaland	191027	178173	276084	240365	415910	359020
Orissa	8770586	8778260	11041083	10903532	13309786	13060485
Punjab	6007566	5127503	7266515	6284545	8937210	7851705
Rajasthan	10564082	9591520	13484383	12281423	17854154	16407708
Sikkim	85193	76996	112662	97181	172440	143945
Tamil Nadu	16910978	16775975	20828021	20371147	24487624	23920453
Tripura	591237	550768	801126	755216	1054846	998212
Uttar Pradesh	38638317	35116256	47016635	41324886	58819535	52042977
West Bengal	18599144	16327135	23435987	20876024	28560901	26019746
Union Territories						
A&N Islands	39304	24244	70027	45106	107261	81480
Chandigarh	72576	47305	147080	110171	255278	196332
D&N Haveli	29524	28439	36964	37206	52515	51161
Delhi	1489378	1169234	2257515	1808183	3440081	2780325
Lakshadweep	11935	12173	16078	15732	20377	19872
Pondicherry	183347	185732	237112	234595	304561	299910
All India	226293201	212941570	284049276	264110376	353374460	329954637

Source : Office of the Registrar General, India

* Includes Daman & Diu

@ : The 1981 figures of population for Assam are interpolated

Table 7.1.1 continued....

TABLE 7.1.1 : POPULATION TOTALS - INDIA AND STATES

States/U.Ts.	1991	
	Male	Female
Andhra Pradesh	33724581	32783427
Arunachal Pradesh	465004	399554
Assam	11657989	10756333
Bihar	45202091	41172374
Goa	594790	575003
Gujarat	21355209	19954373
Haryana	8827474	7636174
Himachal Pradesh	2617467	2553410
Jammu & Kashmir+	4014100	3704600
Karnataka	22951917	22025284
Kerala	14288995	14809523
Madhya Pradesh	34267293	31913877
Maharashtra	40825618	38111569
Manipur	938359	898790
Meghalaya	907687	867091
Mizoram	358978	330778
Nagaland	641282	568264
Orissa	16064146	15595590
Punjab	10778034	9503935
Rajasthan	23042780	20963210
Sikkim	216427	190030
Tamil Nadu	28298975	27559971
Tripura	1417930	1339275
Uttar Pradesh	74036957	65075330
West Bengal	35510633	32567332
Union Territories		
A&N Islands	154369	126292
Chandigarh	358614	283401
D&N Haveli	70953	67524
Daman & Diu	51595	49991
Delhi	5155512	4265132
Lakshadweep	26618	25089
Pondicherry	408081	399704
All India+ (including Jammu & Kashmir)	439230458	407072230

Source : Office of the Registrar General, India

\+ : The 1991 census was not held in Jammu & Kashmir. The projected population of Jammu & Kashmir, is based on the Report of Standing Committee of experts on population projections (October 1989).

The population of India has grown steadily during the period 1951-91. In absolute terms the population of India has increased by 163 million during the decade 1981-91. This addition is almost equal to the population added during the three decades 1931-41, 1941-51, 1951-61. The percent decadal growth rate (exponential) indicates an increase from 2.20 during the decade 1961-71 to 2.22 during the decade 1971-81. However, the growth rate has declined to 2.14 during the decade 1981-91.

In most of the states growth rate has declined during the decade 1981-91. However, the six most populous states of the country namely, Uttar Pradesh, Bihar, Maharashtra, West Bengal, Andhra Pradesh, and Madhya Pradesh accounting 59.75 percent of country's population in 1981 have contributed 62.49 percent of the increase during the decade 1981-91. Whereas the last four states have registered an increase in growth rate, the two states of Uttar Pradesh and Bihar have shown a marginal decline (by less than 1% point) in the growth rate.

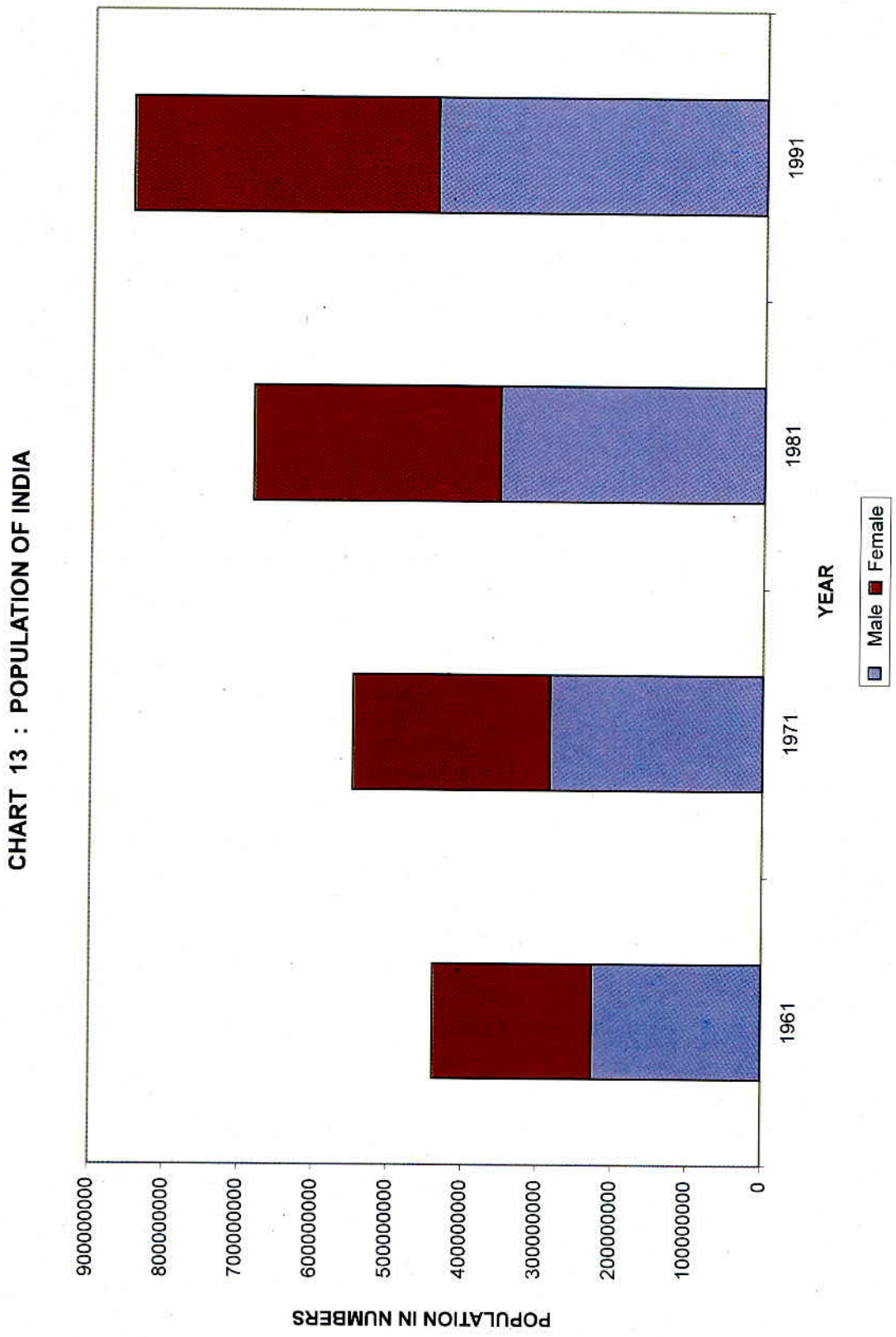


CHART 13 : POPULATION OF INDIA
POPULATION IN NUMBERS
900000000
800000000
700000000
600000000
500000000
400000000
300000000
200000000
100000000
0
1961
1971
1981
1991
YEAR
Male
Female

TABLE 7.1.2 : INFANT MORTALITY RATE

(Per thousand live births)

Year	Sex		Sector		Overall
	Female	Male	Rural	Urban	
1985	98	96	107	59	97
1986	97	96	105	62	96
1987	96	95	104	61	95
1988	93	95	102	62	94
1989	90	92	98	58	91
1990	81	78	86	50	80
1991 *	80	81	87	53	80
1992 *	80	79	85	53	79
1993 *	75	73	82	45	74
1994*	73	75	80	52	74
1995*	76	73	80	48	74
1996*	NA	NA	77	46	72

Source : Registrar General, India
Sample Registration System (Various Years)

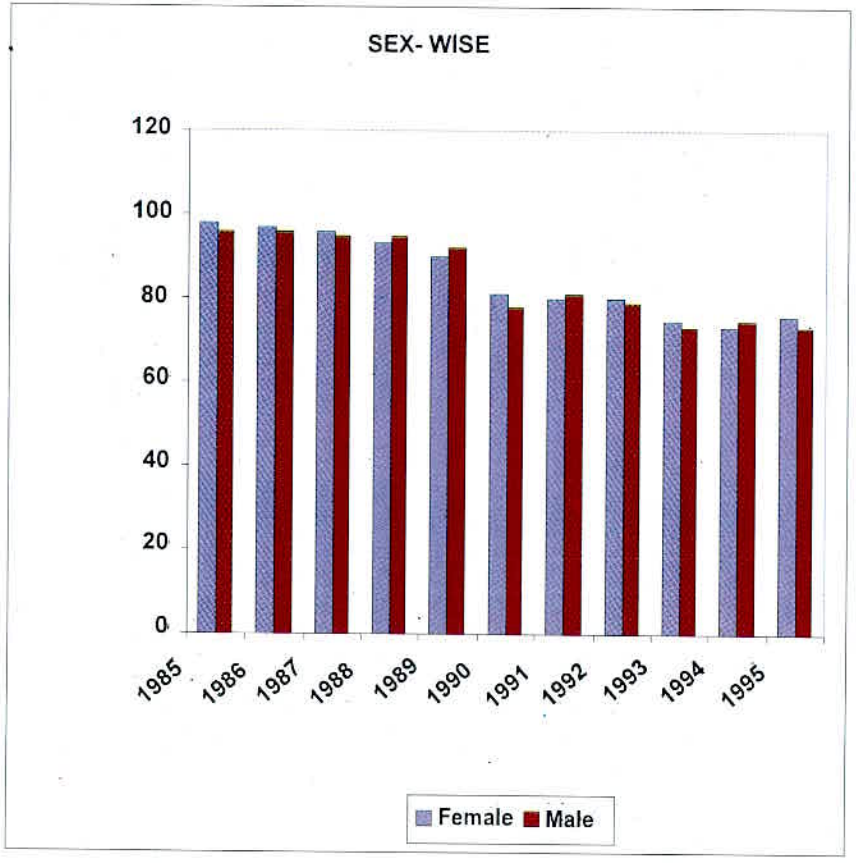
* : Excludes Jammu and Kashmir

NA : Not Available

Infant Mortality Rate(IMR) in India has significantly declined 1970-80 and 1981-90, but the present IMR (72) is still very high in comparison to industrial (14) and even developing countries (64). The decline in the IMR was much greater during the second sub-period (1981-90) than during the first sub-period (1970-80) and this was entirely due to the decline in the IMR in the rural areas. In fact, in urban areas, the situation was reverse, the decline in the IMR was greater during 1970-80 than during 1981-90.

Kerala has recorded the minimum IMR of 16 which in fact is less than that of Costa Rica which is placed at third position among developing countries having lowest IMR. The variability between rural and urban areas is also minimum in Kerala. In contrast, Orissa has the maximum IMR and variability between rural and urban areas is also very high.

CHART 14 : INFANT MORTALITY RATE (PER THOUSAND LIVE BIRTHS)



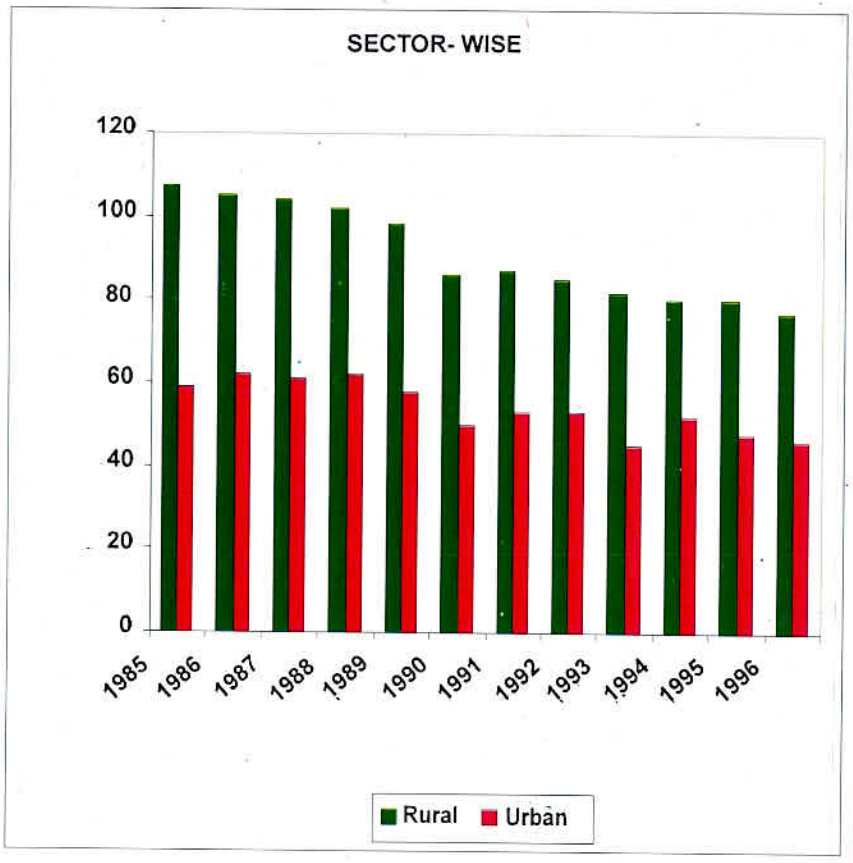


TABLE 7.1.3 : EXPECTATION OF LIFE AT BIRTH

In Years

Year	Female	Male	Combined
1901-11	23.3	22.6	22.9
1911-21	20.9	19.4	20.1
1921-31	26.6	26.9	26.8
1931-41	31.4	32.1	31.8
1941-51	31.7	32.4	32.1
1951-61	40.6	41.9	41.3
1961-71	44.7	46.4	45.6
1970-75	49.0	50.5	49.7
1976-80	52.1	52.5	52.3
1981-85	55.7	55.4	55.4
1986-90	58.1	57.7	57.7
1987-91*	58.6	58.1	58.3
1988-92*	59.0	58.6	58.7
1989-93	59.7	59.0	59.4
1990-94	60.4	59.4	60.0
1991-95	60.9	59.7	60.3

Source : Registrar General, India.

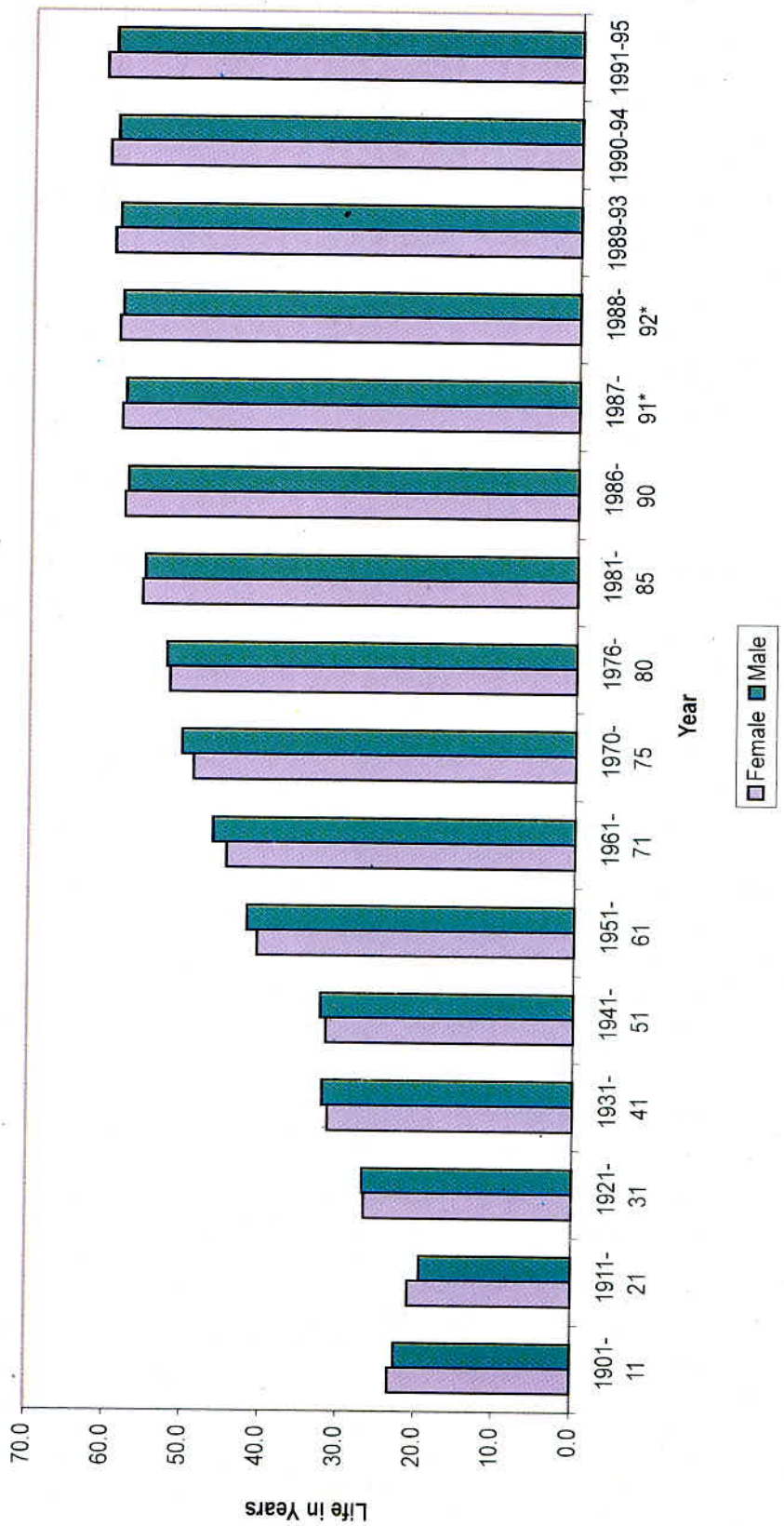
Notes: Figures for 1901-11 to 1961-71 are based on Census Actuarial Reports and for 1970-75 onwards on the basis of estimates from Sample Registration System

* Excludes Jammu and Kashmir

The expectation of life at birth of female which was lower than that of male till 1980 has shown an upward trend during the decade 1981-90. This trend is similar in respect of almost all the states except in a few states i.e. Bihar, Uttar Pradesh, Madhya Pradesh and Orissa. This may be one of the reasons that in these States the combined expectation of life at birth is much lower than the National Average of 57.7(1986-90).

One of the major reasons for the decline in expectation of life in these states can be attributed to rapid growth of population and poverty, more than forty percent population living below the poverty line which is much more than National Average of 35.97 percent.

CHART 15 : EXPECTATION OF LIFE AT BIRTH



The estimates of poverty have been released from the year 1972-73 onward using the full survey data on household consumption expenditure collected by the National Sample Survey Organization (NSSO) at an interval of five years. The estimates are available for the year 1972-73, 1977-78, 1983, 1987-88 and 1993-94. The methodology behind these estimates, often termed as "official methodology" has been outlined in the Appendix VI.

The results show that during the last two decades the percentage of population below poverty line has declined significantly in rural areas as well as in urban areas, but still after 50 years of Independence India is facing an acute problem of poverty. The recent results have revealed that 37.27% of rural population and 32.36% of urban population is living below the poverty line. The Important feature which can be concerned as a cause of satisfaction for planners and policy makers that the rate of decline of poverty in rural areas is much sharper in comparison of urban areas.

CHART 16 : PERCENTAGE OF POPULATION BELOW THE POVERTY LINE

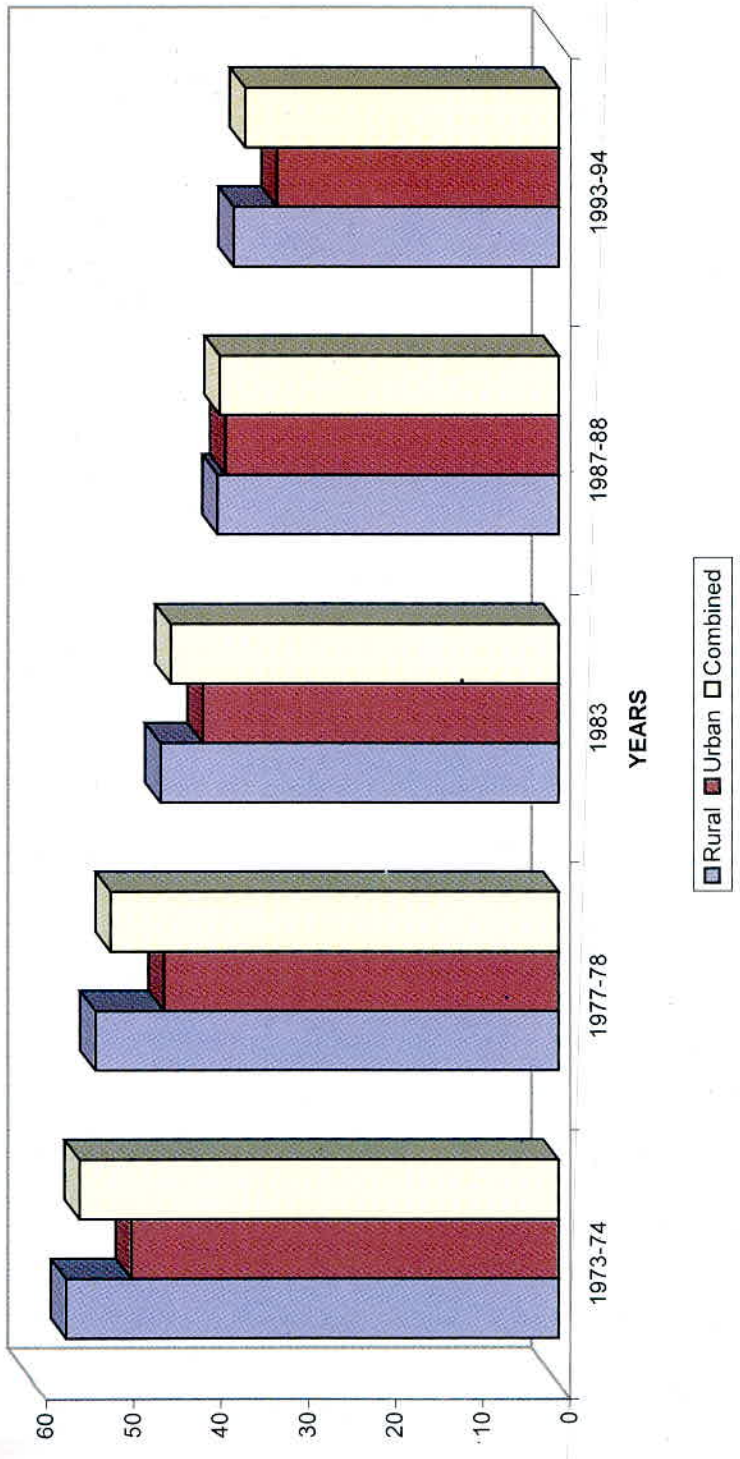


TABLE 7.1.5 : PERCENTAGE DISTRIBUTION OF DEATHS BY MAJOR CAUSE GROUPS, INDIA (RURAL) 1989-93

S. No.	Major Cause Groups	1989	1990	1991	1992	1993	1994	1995
1	Senility	23.8	24.4	23.8	23.5	22.9	21.2	14.9
2	Coughs (Disorders of respiratory system)	20.2	18.8	18.9	19.6	19.2	19.3	20.7
3	Causes peculiar to infancy	9.8	9.8	10.2	9.6	11.0	9.6	9.8
4	Diseases of Circulatory System	10.9	11.1	11.1	10.8	10.6	11.2	12.5
5	Other Clear Symptoms	8.2	8.5	8.3	8.4	8.9	10.3	12.6
6	Accident & Injuries	7.4	8.5	8.5	8.7	8.4	8.8	10.3
7	Digestive Disorders	6.6	6.2	6.4	6.2	6.8	6.2	6.3
8	Fevers	7.4	7.3	7.3	7.7	6.7	7.3	7.2
9	Disorders of the Central Nervous System	4.8	4.2	4.4	4.5	4.2	5.0	4.8
10	Child Birth and Pregnancy	0.9	1.0	1.1	1.0	1.3	1.1	0.9
All Causes		100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source :Office of RGI, Survey of Causes of Death (Rural) India, Annual Report 1993

TABLE 7.2.1: URBAN-RURAL BREAK-UP OF TOTAL POPULATION, NUMBER OF HOUSEHOLDS, LIVING QUARTERS AND AVERAGE SIZE OF HOUSEHOLDS AND PERSONS IN LIVING QUARTERS

Year	Total Population	No. of Households	No. of living quarters**	Av.size of Households	Av. No of household residing per living quarters	Av. No. of persons per living quarters
1981*						
Total	665287849	119772545	121782109	5.6	1.0	5.5
Urban	157680171	28905949	29897491	5.5	1.0	5.3
Rural	507607678	90866596	91884618	5.6	1.0	5.5
1991+						
Total	838583988	152009467	159425666	5.5	1.0	5.3
Urban	215771612	40418141	43518317	5.3	1.1	5.0
Rural	622812376	111591326	115907349	5.6	1.0	5.4

Source:Office of Registrar General of India

* :Excluding Assam

\+ :Excluding J & K

** :No. of Occupied residential houses + No. of census houses vacant at the time of house listing.

TABLE 7.2.2 : NUMBER OF HOUSEHOLDS, POPULATION AND LIVING QUARTERS WITH RURAL URBAN BREAK-UP

	Number of Households	Population			No. of houses vacant at the time of houselisting
		Total	Male	Female	
1981*					
Total					
Housing units	119772545	665287849	343930423	321357426	121782109
Conventional dwelling	119772545	665287849	343930423	321357426	
Occupied	119772545	665287849	343930423	321357426	113735542#
Vacant					8046567 $
Institutions		3790700	3116289	674411	
Urban					
Housing units	28905949	157680171	83876403	73803768	29897491
Conventional dwelling	28905949	157680171	83876403	73803768	
Occupied	28905949	157680171	83876403	73803768	27604947#
Vacant					2292544$
Institutions		2377559	1956711	420848	
Rural					
Housing units					91884618
Conventional dwelling	90866596	507607678	260054020	247553658	86130595#
Occupied	90866596	507607678	260054020	247553658	
Vacant					5754023$
Institutions		1413141	1159578	253563	
1991+					
Total					
Housing units	152009467	83858988	435216358	403367630	159425666
Conventional dwelling					
Occupied					147013766#
Vacant					12411900$
Institutions		4252976	3351584	901392	
Urban					
Housing units	40418141	215771612	113936953	101834659	43518317
Conventional dwelling					
Occupied					39073337#
Vacant					4444980$
Institutions		2406841	1893949	512892	
Rural					
Housing units	111591326	622812376	321279405	301532971	115907349
Conventional dwelling					
Occupied					107940429#
Vacant					7966920$
Institutions		1846135	1457635	388500	

Source: Registrar General of India

\# : No. of occupied residential houses

$: No. of census house

* : Excluding Assam

'+ : Excluding Jammu & Kashmir

TABLE 7.2.3 : OCCUPIED HOUSING UNITS BY NUMBER OF ROOMS PER HOUSING UNITS,NUMBER AND PERCENTAGE,TOTAL NUMBEROF ROOMS, AVERAGE SIZE OF HOUSING UNIT AND AVERAGE NUMBER OF PERSONS PER ROOM FOR RURAL AND URBAN AREAS AND MAJOR CITIES

	Total occupied housing units	Occupied housing units by number of rooms						Total number of rooms for all units	Av. Size (room per unit)	Av.no. of persons per room
		One room units	Two room units	Three rooms units	Four room units	Five or more rooms	unknown			
1981*										
Total	118814803	53046175	33948809	14496724	7482461	6852624	2788010	242795971	2.0	2.7
Rate	100.0	44.7	28.6	12.2	6.3	5.8	2.4			
Urban	28541877	13072617	7947026	3484741	1804721	1626979	605793	60924094	2.1	2.6
Rate	100.0	45.8	27.8	12.3	6.3	5.7	2.1			
Rural	90072926	39973558	26001783	11011983	5677740	5225645	2182217	181871877	2.0	2.8
Rate	100.0	44.4	28.9	12.2	6.3	5.8	2.4			
1991+										
Total	151032898	61154743	46180064	20910465	10791101	10608294	1388231			
Rate	100.0	40.5	30.6	13.8	7.2	7.0	0.9			
Urban	39493450	15620078	11992915	5852191	3070829	2751947	205490			
Rate	100.0	39.5	30.4	14.8	7.8	7.0	0.5			
Rural	111539448	45534665	34187149	15058274	7720272	7856347	1182741			
Rate	100.0	40.8	30.7	13.5	6.9	7.0	1.1			
Mumbai										
1981	1580095	1088460	267395	98185	30710	16770	78575	2234755	1.4	3.7
Rate	100.0	68.9	16.9	6.2	1.9	1.1	5.0			
1991	2663015	1886150	538090	170745	46260	21530	240			
Rate	100.0	70.8	20.2	6.4	1.7	0.8	N			
Calcutta										
1981	1713255	965255	413990	158000	70985	50800	54225	2992665	1.7	3.1
Rate	100.0	56.3	24.2	9.2	4.1	3.0	3.2			
1991	2150290	1185565	522980	225440	105325	106115	4865			
Rate	100.0	55.2	24.3	10.5	4.9	4.9	0.2			
Delhi										
1981	1116796	615415	291972	123108	52889	31755	1657	2072817	1.9	2.8
Rate	100.0	55.1	26.2	11.0	4.7	2.8	0.2			
1991	1689166	756596	456325	262271	122691	88363	2920			
Rate	100.0	44.8	27.0	15.5	7.3	5.2	0.2			
Chennai										
1981	831535	379660	248275	109140	55435	39000	25	1661270	2.0	2.6
Rate	100.0	45.7	29.9	13.1	6.7	4.7	N			
1991	1080695	445250	343435	163275	81595	47140	-			
Rate	100.0	41.2	31.8	15.1	7.5	4.4	-			

Source: Registrar General of India

* Excuding Assam Excluding houseless and Institutional Households

\+ Excluding J& K Excluding Institutional households

Note Unknown also includes households with no exclusive rooms

TABLE 7.2.4 : SHORTAGE OF HOUSING IN URBAN AREAS

(as on 01-03-91)

Name of the City	Total Households	No. of Houses	Housing Shortage*	Congestion Factor	Obsolescense Factor	Total Shortage	Shortage (in million)
Greater Mumbai	2683855	2650850	78069	1282239	111336	317644	0.318
Calcutta	2163096	2138750	52150	103356	89828	245333	0.245
Delhi	1701338	1633300	227448	81293	68599	377339	0.377
Chennai	1084963	1071255	127261	51841	44993	224095	0.224
Hydrabad	695173	674090	44811	33216	28312	106339	0.106
Bangalore	798807	793310	34294	38168	33319	105781	0.106
Ahmedabad	666107	649005	31510	31828	27258	90596	0.091
Pune	493456	489775	13574	23578	20571	57723	0.058
Kanpur	358794	355360	15978	17144	14925	48047	0.048
Nagpur	301567	287825	26003	14409	12089	52501	0.053
Lucknow	300622	299090	17144	14364	12562	44070	0.044
Surat	286817	270350	27362	13705	11355	52421	0.052
Jaipur	267324	266410	8880	12773	11189	32842	0.033
Kochin	210582	206525	17419	10062	8674	36155	0.036
Vadodara	218627	187030	35936	10446	7855	54238	0.054
Indore	182438	180905	8516	8717	7598	24831	0.025
Coimbatore	232461	231540	9349	11107	9725	30181	0.030
Patna	165538	154270	19228	7910	6479	33617	0.034
Madurai	200058	198975	15867	9559	8357	33783	0.034
Bhopal	196232	193605	19374	9376	8131	36882	0.037
Vishakhapatnam	221048	219750	62498	10562	9230	82290	0.082
Ludhiana	165866	147805	20943	7925	6208	35076	0.035
Varanasi	133656	121270	13696	6386	5093	25175	0.025
Total	13728425	13421045	927310	655966	563684	2146959	2.147

Source : National Building Organization, Ministry of Urban Affairs & Employment

Notes :

1. These estimates are based on provisional data.
2. Due to non-availability of data, CONGESTION factor has been worked out on the basis of 1991 Congestion factor for urban area.
3. Dilapidation/OBSOLESCENCE Factor has been worked out based on this factor for urban areas.

* Without Congestion and obsolescence factor.

TABLE 7.2.5 : NUMBER OF HOMELESS HOUSEHOLDS AND POPULATION SEXWISE WITH RURAL URBAN BREAK-UP

	Numbers of homeless households	Homeless population		
		Total	Male	Female
1981*				
Total	629929	2342954	1376512	966442
Urban	209520	618843	406154	212689
Rural	420409	1724111	970358	753753
1991+				
Total	522445	2007489	1180368	827121
Urban	216917	725592	471077	254515
Rural	305528	1281897	709291	572606

Source: Registrar General of India

* Excluding Assam

+ Excludes Jammu & Kashmir

TABLE 7.2.6: SIZE/CLASS-WISE IDENTIFIED/ESTIMATED SLUM POPULATION IN 1991.

(POPULATION IN LAKHS)

Sl. No.	Size-class category of Cities/Towns	No. of Cities/ Towns	Total popu-lation	Slum popu-lation	Percentage to total population	Percentage of total slum population
1	>10 Lakh population	23	709.966	188.659	26.6	41.3
2	5-10 lakh population	31	214.500	42.555	19.8	9.3
3	3-5 lakh population	39	151.239	28.596	18.9	6.3
4	1-3 lakh population	207	325.139	54.493	16.8	11.9
	Total class-I	300	1400.844	314.303	22.4	68.8
5	50,000 to 99,999 population	345	236.288	47.151	20	10.3
6	<50,000 population	3052	520.581	95.232	18.3	20.9
	Total	3697	2157.713 *	456.686 *	21.2	100

Source: A Compendium on Indian Slums ,1996, Town and Country Planning Organisation
: Excluding Jammu & Kashmir

The existence of slums is essentially manifestation of poverty, alongwith the economic growth and with industrial development, slums will continue to exist. Inspite of the efforts to contain the number of slum dwellers, it has been increasing fast which is causing tremendous pressure in urban basic services and infrastructure. The Slum population in the country as on 1991 was of the order of 463 lakh constituents nearly 21 percent of the urban population.The distribution of urban population indicates the preponderance of slum dwellers in the 23 metropolitan cities of the country which accommodates about 26.6 percent of the total population of these centres. The Sproutary of slums in urban areas is the direct outcome of better economic opportunities available in cities and towns.

TABLE 7.2.7 : STATEWISE IDENTIFIED/ ESTIMATED SLUM POPULATION

(Population in lakhs)

S.No.	State/Uts	1981			1991			2001		
		Urban population	Identified slum population	% age	Urban population	Estimated slum population	% age	Urban Population	Estimated slum Population	% age
1	Andhra Pradesh	124.876	28.579	22.9	178.871	43.133*	24.1	249.654	60.166	24.1
2	Arunachal Pradesh	0.414	Nil	Nil	1.106	0.221	20.0	1.879	0.375	20.0
3	Assam	17.824	1.236	6.9	24.878	4.483+	18.0	32.367	5.826	18.0
4	Bihar	87.190	32.699	37.5	113.530	26.906	23.7	149.556	35.444	23.7
5	Goa	3.518	0.242	6.9	4.798	0.833	17.4	6.559	1.141	17.4
6	Gujarat	106.017	15.316	14.4	142.461	25.814*	18.1	189.993	34.388	18.1
7	Haryana	28.274	2.742	9.7	40.547	6.843*	16.9	59.572	10.067	16.9
8	Himachal Pradesh	3.260	0.761	23.3	4.492	1.258+	28.0	5.765	1.614	28.0
9	Jammu & Kashmir	12.604	6.270	49.7	18.394	5.922	32.2	24.173	7.783	32.2
10	Karnataka	107.296	5.745	5.4	139.078	12.934	9.3	190.989	17.761	9.3
11	Kerala	47.713	4.101	8.6	76.803	12.218	15.9	103.474	16.452	15.9
12	Madhya Pradesh	105.865	10.749	10.2	153.388	21.029	13.7	204.050	27.954	13.7
13	Maharashtra	219.936	43.149	19.6	305.416	78.724	25.8	416.155	107.367	25.8
14	Manipur	3.755	0.165	4.4	5.056	0.853	16.9	6.702	1.132	16.9
15	Meghalaya	2.413	0.660	27.4	3.300	0.833+	25.2	4.608	1.161	25.2
16	Mizoram	1.218	Nil	Nil	3.179	0.572	18.0	6.424	1.156	18.0
17	Nagaland	1.202	Nil	Nil	2.082	0.416	20.0	3.049	0.609	20.0
18	Orissa	31.103	2.820	9.1	42.350	8.432*	19.9	56.320	11.207	19.9
19	Punjab	46.478	11.668	25.1	59.932	14.144*	23.6	80.241	18.936	23.6
20	Rajasthan	72.105	10.252	14.2	100.671	24.000+	23.8	137.193	32.651	23.8
21	Sikkim	0.511	0.024	4.7	0.370	0.095+	25.7	0.479	0.123	25.7
22	Tamil Nadu	159.519	26.760	16.8	190.776	35.713*	18.7	233.080	43.585	18.7
23	Tripura	2.256	0.184	8.2	4.217	0.744*	17.6	5.078	0.893	17.6
24	Uttar Pradesh	198.991	25.800	13.0	276.059	58.391*	21.1	365.397	77.098	21.1
25	West Bengal	144.467	30.280	21.0	187.076	51.949	27.8	236.620	65.780	27.8
	Total States	1528.805	260.202	17.0	2078.830	436.460	21.0	2769.377	580.669	21.0
26	Andaman & Nicobar Is	0.496	Nil	Nil	0.750	0.349+	46.5	1.102	0.512	46.5
27	Chandigarh	4.228	Nil	Nil	5.758	1.612	28.0	7.618	2.133	28.0
28	Dadra & Nagar Haveli	0.069	Nil	Nil	0.117	0.023	19.7	0.199	0.039	19.6
29	Daman and Diu**	Nil	Nil	Nil	0.475	0.095	20.0	0.698	0.139	19.9
30	Delhi	57.682	18.000	31.2	84.716	22.480+	26.5	122.891	32.566	26.5
31	Lakshadweep	0.186	Nil	Nil	0.291	0.058+	19.9	0.362	0.072	19.9
32	Pondicherry	3.160	0.942	29.8	5.170	1.531	29.6	7.190	2.128	29.6
	Total Uts	65.821	18.942	28.8	97.277	26.148	26.9	140.060	37.589	26.8
	Grand Total	1594.626	279.144	17.5	2176.107	462.608	21.3	2909.437	618.258	21.3

Source: A Compendium on Indian Slums ,1996, Town and Country Planning Organisation

\+ : Figures of identified/estimated slum population have been furnished (for the state as a whole) by the respective Stal Governments.

* : Slum population estimates are based on the information (for Class-I and Class-II cities/towns) received from the State/Ut's Government for the Year 1991.

** : Figures of 1981 have already been included in Goa.

TABLE 7.2.8 : STATE-WISE IDENTIFIED/ESTIMATED PERCENTAGE DISTRIBUTION OF SLUM POPULATION ACCORDING TO SIZE/CLASS CATEGORIES OF CITIES/TOWNS IN 1991

Sr. No.	States/Uts.	Percentage Distribution			Total Slum population (in lakhs)
		Class I	Class II	Others	
1	Andhra Pradesh	63.3	15.5	21.2	43.133
2	Arunachal Pradesh	-	-	100.0	0.221
3	Assam	62.5	16.1	21.4	4.483
4	Bihar	68.4	18.6	13.0	26.906
5	Goa	-	7.3	92.7	0.833
6	Gujarat	72.4	12.2	15.4	25.814
7	Haryana	52.5	22.4	25.1	6.843
8	Himachal Pradesh	27.2	-	72.8	1.258
9	Jammu & Kashmir	-	-	-	-
10	Karnataka	72.3	8.8	18.9	12.934
11	Kerala	50.4	2.7	46.9	12.218
12	Madhya Pradesh	48.5	16.1	35.4	21.029
13	Maharashtra	82.5	4.5	13.0	78.724
14	Manipur	25.0	-	75.0	0.853
15	Meghalaya	50.4	-	49.6	0.833
16	Mizoram	48.8	-	51.2	0.572
17	Nagaland	-	46.9	53.1	0.416
18	Orissa	43.0	15.4	41.6	8.432
19	Punjab	65.3	18.7	16.0	14.144
20	Rajasthan	51.2	5.5	43.3	24.000
21	Sikkim	-	-	100.0	0.095
22	Tamil Nadu	67.8	13.2	19.0	35.713
23	Tripura	33.6	-	66.4	0.744
24	Uttar Pradesh	53.9	14.8	31.3	58.391
25	West Bengal	87.2	4.1	8.7	51.949
	Total States	67.1	10.8	22.1	430.538
26	Andaman & Nicobar Is	-	100.0	-	0.349
27	Chandigarh	100.0	-	-	1.612
28	Dadra & Nagar Haveli	-	-	100.0	0.023
29	daman and Diu	-	-	100.0	0.058
30	Delhi	100.0	-	-	22.480
31	Lakshadweep	-	-	100.0	0.058
32	Pondicherry	76.9	14.4	8.6	1.531
	Total Uts	96.6	2.2	1.2	26.148
	Grand Total	68.8	10.3	20.9	456.686*

Source: A Compendium on Indian Slums ,1996, Town and Country Planning Organisation

* : Excluding Jammu & Kashmir

TABLE 7.2.9 : ESTIMATED SLUM POPULATION IN METROPOLITAN CITIES

(Population in lakhs)

S.No.	Name of City	1981			1991			2001*		
		Total Population	Slum Population	%age	Total Population	Slum Population	%age	Total Population	Slum Population	%age
1	Calcutta UA	91.940	30.280	32.9	110.219	36.262 @	32.9	131.147	43.147	32.9
2	Greater Mumbai UA	89.887	30.831	34.3	125.962	43.205 @	34.3	170.701	58.550	34.3
3	Delhi UA	57.228	18.000	31.5	84.191	22.480	26.7	122.204	32.628	26.7
4	Chennai UA	42.893	13.769	32.1	54.220	15.251	28.1	69.823	19.620	28.1
5	Hyderabad UA	25.500	5.000	19.6	43.444	8.593	19.8	62.964	12.466	19.8
6	Bangalore UA	29.218	3.650	12.5	41.303	5.162	12.5	63.597	7.949	12.5
7	Ahmedabad UA	25.480	5.172	20.3	33.122	6.724 @	20.3	43.629	8.859	20.3
8	Pune UA	17.222	2.807	16.3	24.940	4.065 @	16.3	35.299	5.753	16.3
9	Kanpur UA	16.391	6.140	37.5	20.299	4.172	20.6	24.875	5.124	20.6
10	Lucknow UA	10.076	2.850	28.3	16.692	2.778	16.6	22.581	3.748	16.6
11	Nagpur UA	12.195	3.890	31.9	16.640	5.308 @	31.9	23.212	7.405	31.9
12	Jaipur UA	10.152	2.958	29.1	15.182	4.418 @	29.1	22.108	6.433	29.1
13	Surat UA	9.239	2.347	25.4	15.190	3.858 @	25.4	22.916	5.821	25.4
14	Coimbatore UA	9.204	0.801 +	8.7	11.007	0.958	8.7	13.283	1.156	8.7
15	Cochin UA	8.249	2.046	24.8	11.406	2.829 @	24.8	15.364	3.810	24.8
16	Vadodara UA	7.449	1.182	15.9	11.268	2.063	18.3	17.074	3.125	18.3
17	Indore UA	8.293	1.263	15.2	11.091	1.686 @	15.2	15.430	2.345	15.2
18	Patna UA	9.189	5.837	63.5	10.996	6.982 @	63.5	15.273	9.698	63.5
19	Madurai UA	9.077	1.634 +	18.0	10.859	1.953	18.0	13.134	2.364	18.0
20	Bhopal UA	6.710	0.568	8.5	10.628	1.487 **	14.0	15.327	2.145	14.0
21	Vishakhapatnam UA	6.036	1.520	25.2	10.571	2.664	25.2	16.683	4.204	25.2
22	Varanasi UA	7.972	2.600	32.6	10.309	2.074	20.1	13.314	2.676	20.1
23	Ludhiana	6.071	3.104	51.1	10.427	3.687	35.4	16.342	5.785	35.4
Total		515.671	148.249	28.7	709.966	188.659	26.6	966.280	254.811	26.4

Source : National Building Organization, Ministry of Urban Affairs & Employment

Note :

Classification of the size of cities is based on 1991 census.

@ Based on the percentage identified slum population of 1981.

\+ Based on the percentage identified slum population of 1991.

* Estimated

TABLE 7.2.10: OCCUPIED HOUSING UNITS BY WATER SUPPLY SYSTEM AND TOILET INSTALLATION BY RURAL AND URBAN CITIES

	Total Occupied Housing unit	Water supply system With piped water			Toilet Installation	
		Total	Inside	Outside	With toilet of any type	Without toilet of any type
1981*						
Total	118614803	27317532	12851006	14466526		
Percentage	100.0	23.0	10.8	12.2		
Urban	28541877	18049114	10302247	7746867	16596103	11945774
Percentage	100.0	63.2	36.1	27.1	58.1	41.9
Rural	90072926	9268418	2548759	6719659		
Percentage	100.0	10.3	2.8	7.5		
1991+						
Total	151111383	48745490	23414175	25331315	35819780	115291603
Percentage	100.0	32.3	15.5	16.8	23.7	76.3
Urban	39523184	25713794	16691096	9022698	25236449	14286735
Percentage	100.0	65.1	42.3	22.8	63.9	36.1
Rural	111588199	23031696	6723079	16308617	10583331	101004868
Percentage	100.0	20.6	6.0	14.6	9.5	90.5

Source: Registrar General of India

* Excluding Assam, Excluding Institutional and houseless households

\+ Excluding J&K

Access to safe drinking water remains an urgent need as only 65.1% of occupied housing unit in urban areas received organized piped water supply and rest have to depend on surface or ground water which is untreated. The situation in rural areas is much worst. In India, almost all surface water sources are contaminated and unfit for human consumption. The diseases commonly caused due to containated water are diarrhea, trachoma, intestine worms, hepatitis. Inadequate access to safe drinking water and sanitation facilities leads to infant mortality and intestinal diseases.

TABLE 7.2.11: POPULATION COVERED WITH DRINKING WATER AND SANITATION FACILITIES

Items/ Areas	(Percentage coverage as on 31st March)		
	1985	1990	1993*
Drinking Water Supply			
Rural	56.3	73.9	78.4
Urban	72.9	83.8	84.9
Sanitation Facilities			
Rural	0.7	2.4	3.15
Urban	28.4	45.9	47.90

Source : Planning Commission

* Provisional

TABLE 7.2.12: STATEWISE ANNUAL REQUIREMENT OF WATER FOR DOMESTIC PURPOSES IN DIFFERENT STATES

S. No.	State/UT	Water Requirement During 1991	Estimated for 2001
1	Andhra Pradesh	2.15	2.498
2	Arunachal Pradesh	0.024	0.029
3	Assam	0.632	0.883
4	Bihar	2.496	3.242
5	Goa	0.043	0.052
6	Gujarat	1.413	1.644
7	Haryana	0.519	0.663
8	Himachal Pradesh	0.141	0.161
9	Jammu & Kashmir	0.244	0.287
10	Karnataka	1.499	1.892
11	Kerala	0.938	1.102
12	Madhya Pradesh	2.082	2.545
13	Maharashtra	2.791	3.199
14	Manipur	0.06	0.074
15	Meghalaya	0.053	0.072
16	Mizoram	0.025	0.035
17	Nagaland	0.036	0.052
18	Orissa	0.913	1.143
19	Punjab	0.669	0.791
20	Rajasthan	1.378	1.884
21	Sikkim	0.011	0.019
22	Tamil Nadu	1.907	2.234
23	Tripura	0.08	0.088
24	Uttar Pradesh	4.258	5.59
25	West Bengal	2.212	2.551
26	Andaman & Nicobar Islands	0.009	0.015
27	Chandigarh	0.031	0.06
28	Dadra & Nagar Haveli	0.004	0.005
29	Lakshadweep	0.002	0.003
30	Pondicherry	0.033	0.036
31	Delhi	0.455	0.668
32	Daman & Diu	0.003	0.004
	All India	**27.111**	**33.521**

Source : Water Resources of India, 1988
Central Water Commission (W.M. Directorate)

TABLE 7.2.13: PROGRESS OF COVERAGE OF PROBLEM VILLAGES WITH SUPPLY OF DRINKING WATER

S.No.	Name of State/UT	Total No. of Villages (1981 Census)	Problem villages as on 1-4-85	Coverage of PVs during VII Plan (1985 90)	Problem villages Balance as on 1 4-90	Coverage of PVs during (1990-91)	Coverage of PVs during (1991-92)	Coverage of PVs during (1992-93)	Coverage of PVs during (1993-94)	Coverage of PVs during (1994-95)	Problem villages Balance as on 1-4-95
1	Andhra Pradesh	27379	15834	15834	0	0	0	0	0	----	0
2	Arunachal Pradesh	3257	391	391	0	0	0	0	0	----	0
3	Assam	21995	9570	9126	444	356	74	4	5	2	3
4	Bihar	67546	9199	9155	44	37	7	0	0	----	0
5	Goa	386	31	31	0	0	0	0	0	----	0
6	Gujarat	18114	4911	4812	99	47	24	17	2	----	9
7	Haryana	6745	2314	2143	171	96	75	0	0	----	0
8	Himachal Pradesh	16807	3539	2432	1107	310	460	337	0	----	0
9	Jammu & Kashmir	6477	2959	2054	905	243	341	93	76	107	45
10	Karnataka	27028	5410	5410	0	0	0	0	0	----	0
11	Kerala	1219	88	87	1	1	0	0	0	----	0
12	Madhya Pradesh	71352	14714	14568	146	63	48	35	0	----	0
13	Maharashtra	39354	5174	5076	98	46	13	17	0	----	22
14	Manipur	2035	862	862	0	0	0	0	0	0	0
15	Meghalaya	4902	3658	2237	1421	406	240	491	210	20	54
16	Mizoram	721	595	527	68	68	0	0	0	----	0
17	Nagaland	1112	623	597	26	7	19	0	0	----	0
18	Orissa	46553	14443	13123	1320	219	551	530	20	----	0
19	Punjab	12342	2254	1306	948	164	276	508	0	----	0
20	Rajasthan	34968	7310	6910	400	261	50	25	51	----	13
21	Sikkim	440	121	114	7	7	0	0	0	----	0
22	Tamil Nadu	15831	4882	4864	18	18	0	0	0	----	0
23	Tripura	4727	2893	2763	130	120	0	7	0	3	0
24	Uttar Pradesh	112566	43906	42894	1012	563	187	154	108	----	0
25	West Bengal	38024	5930	5930	0	0	0	0	0	----	0
26	Andaman & Nicobar Islands	491	40	40	0	0	0	0	0	----	0
27	Chandigarh	24	0	0	0	0	0	0	0	----	0
28	Dadra & Nagar Haveli	70	0	0	0	0	0	0	0	----	0
29	Lakshadweep	7	11	11	0	0	0	0	0	----	0
30	Pondicherry	291	53	53	0	0	0	0	0	----	0
31	Delhi	214	0	0	0	0	0	0	0	----	0
32	Daman & Diu	26	7	7	0	0	0	0	0	----	0
	All India	583003	161722	153357	8365	3032	2365	2218	472	132	146

Problem Villages(PV) : Problem villages means where drinking water is not available with in a radius of 1.6 km in plain areas and within elevation difference of 100 m in hilly areas

Source: Ministry of Rural Areas and Employment

In India, about 78% of the urban population has access to safe drinking water and about 38% of the urban population has access to sanitation services. In the rural areas approximately 35% have access to water supply and about 12% have access to sanitation services. Monitoring done by CPCB for many rivers and wells in India has revealed that the total coliform count far exceeds the desired level in water fit for human consumption. Water for human consumption should usually contain zero fecal coliform per 100 milliliter sample, and bathing water and water for irrigation should contain less than 1000 fecal coliform per 100 milliliter sample. Almost all rivers however, do not meet the standards for safe drinking water (CPCB 1990). The impact of drinking water pollution is more severe on the poor.

TABLE 7.3.1 : URBANISATION TRENDS IN INDIA

Census year	Urban Population (Million)	Urban as % of Total Population	Growth rate %	
			Decennial	Annual Exponential
1901	25.85	10.84	--	--
1971	109.11	19.91	38.23	3.21
1981	159.46	23.34	46.14	3.83
1991	217.61	25.71	36.47	3.09

Source: 1. Census of India 1991,Provisional Population Totals Rural Urban Distribution, Paper 2 of 1991

2. Census of India 1991, Final Population Tables, Paper 2 of 1992

TABLE 7.3.2: DECENNIAL GROWTH RATES OF URBAN POPULATION IN EACH SIZE CLASS

Srl. No.	Size Class	Growth %	
		1971-81	1981-91
1	100,000 & above	55.61	45.00
2	50,000-99,999	54.29	28.28
3	20,000-49,999	28.46	29.95
4	10,000-19,999	25.72	14.19
5	5,000-9,999	15.31	2.82
6	Under 5,000	61.68	-18.45
	All Classes	46.23	36.35

Source: Registrar General of India.

Note : The above figures Excludes the figures of J&K and Assam

Twenty Five percent of the population in India resides in urban areas as per the report of 1991 census. The percentage of urban population to total population has shown a significant rate of increase in growth of urbanization during the last two decades. This is mainly due to better job opportunities in urban areas and lack of basic services in rural areas.

The analysis has revealed that rural areas are still far behind in respect of infant mortality rate, per capita income, access to safe drinking water, Sanitation facilities etc. which are the most important indicators of human development. This has lead to rapid growth of urbanization at an annual rate of 3.5% to 3.8% against the population growth rate of 2.14% during the last decade 1981-91. The growth rate is maximum in respect of cities having population of one lakh and above.

It has been predicted that by end of the 20th century, Calcutta and Mumbai will be among the ten largest cities of the world with an estimated population of 15.9 million and 15.4 million respectively(Human Development Report).

TABLE 7.3.3 : URBAN AGGLOMERATION/ CITIES HAVING POPULATION OF OVER ONE MILLION

Census year	Number of urban Agglomeration/ cities	Population (Million)	% of population of urban	
			Total Population	Urban Population
1901	1	1.51	0.63	5.84
1911	2	2.79	1.11	10.76
1921	2	3.17	1.26	11.28
1931	2	3.45	1.24	10.32
1941	2	5.37	1.68	12.16
1951	5	12.00	3.32	19.22
1961	7	18.47	4.21	23.40
1971	9	28.48	5.20	26.10
1981@	12	43.33	6.34	27.17
1991+	23	71.00	8.39	32.63

Source: Office of Registrar General of India.

Notes :

@ : The 1981 census could not be held in Assam and the proportional figures for 1981 for Assam have been worked out by interpolation.

+ : The 1991 census was not held in J&K. The proportional figures include the projected population for J&K.

TABLE 7.3.4: PERCENT OF TOTAL POPULATION IN URBAN AREAS BY SIZE OF TOWNS - INDIA

Class and size of towns in terms of population	1951	1961	1971	1981	1991
Class I : 100000 & above	7.7	9.19	11.25	14.04	16.44
Class II : 50000-99,999	1.69	1.96	2.15	2.66	2.76
Class III : 20000-49,999	2.65	2.93	3.07	3.16	3.31
Class IV : 10000-19,999	2.3	2.24	2.11	2.13	1.96
Class V : 5000- 9,999	2.2	1.2	0.85	0.79	0.65
Class VI : Less than 5000	0.53	0.13	0.09	0.11	0.07
Urban population as percent of total population	17.29	17.97	19.91	23.34+	25.71*
Total Population (million)	361.09	439.23	548.16	'683.33	846.30*

Note : Size class-wise percentage do not add up to percentage of total urban population as data on Assam and Jammu & Kashmir are excluded in the size class-wise distribution.

\+ Includes the interpolated population of Assam in 1981

* Includes the projected population of J&K in 1991

Source : Office of the Registrar General, India

TABLE 7.4.1 : HAZARDOUS WASTE REGULATORY QUANTITIES

Waste category (numbers)	Types of wastes	Regulatory quantities
1.	Cyanide wastes	1 kilogram per year calculated as cyanide
2.	Metal finishing wastes	10 kilograms per year the sum of the specified substance calculated as pure metal
3.	Waste containing water soluble chemical compounds of lead, copper, zinc, chromium, nickle, selenium, barium and antimony	10 kilograms per year the sum of the specified substance calculated as pure metal
4.	Mercury, arsenic, thallium, and cadmium bearing wastes	5 kilograms per year the sum of the specified substance calculated as pure metal
5.	Non-halogenated hydrocarbons including solvents	200 kilograms per year calculated as non-halogenated hydrocarbons
6.	Halogenated hydrocarbons including solvents	50 kilograms per year calculated as halogenated hydrocarbons
7.	Wastes from paints, pigments, glue, varnish and printing ink	250 kilograms per year calculated as oil or oil emulsions
8.	Wastes from dyes and dye intermediates containing inorganic chemical compounds	200 kilograms per year calculated as inorganic chemicals
9.	Wastes from dyes and dye intermediates containing organic chemical compounds	50 kilograms per year calculated as organic chemicals
10.	Waste oils and emulsions	1000 kilograms per year calculated as oil emulsions
11.	Tarry wastes from refining and tar residues from distillation or pyrolytic treatment	200 kilograms per year calculated as tar
12.	Sludge arising from treatment of waste water containing heavy metals, toxic organics, oils, emulsions, and spend chemicals and incineration ash	irrespective of any quantity
13.	Phenols	5 kilograms per year calculated as phenols
14.	Asbestos	200 kilograms per year calculated as asbestos
15.	Wastes from manufacture of pesticides, herbicides, and residues from pesticides and herbicide formulation units.	200 kilograms per year calculated as pesticides and their intermediate products
16.	Acidic/alkaline/slurry wastes	200 kilograms per year calculated as acids/alkalies
17.	Off-specification and discarded products	irrespective of any quantity
18.	Discarded containers and container liners of hazardous and toxic wastes	irrespective of any quantity

Source : Teri Energy Data Directory & Year Book, 1996/97

TABLE 7.4.2: TOTAL AMOUNT OF SOLID WASTE COLLECTED AND THE COLLECTION EFFICIENCY IN SOME TOWNS/CITIES IN INDIA.

Town	Population (1981)	Solid Waste (Tonnes)		Collection Efficiency % age
		Generated	Collected	
Bombay	8227332	3200	3100	96.9
Madras	4276635	1819	1637	90.0
Bangalore	2913537	1800	1225	68.1
Ahmedabad	2515195	1200	1080	90.0
Kanpur	1688424	2142	1500	70.0
Pune	1685300	1000	700	70.0
Lucknow	1006538	600	500	83.3
Total		11761	9742	82.8
Coimbatore	917155	175	113	64.6
Madurai	904362	310	160	51.6
Indore	827071	120	100	83.3
Baroda	744043	321	193	60.1
Cochine	685686	230	120	52.2
Bhopal	672329	321	300	93.5
Tiruchi	607815	130	60	46.2
Calicut	546060	200	75	37.5
Meerut	538461	120	70	58.3
Hubli-Dharwad	526493	75	60	80.0
Trivendrum	519766	120	75	62.5
Salem	515021	130	25	19.2
Mysore	476446	204	122	59.8
Thane	388577	350	200	57.1
Jamnagar	317037	149	89	59.7
Gulbarga	218621	10	8	80.0
Sambalpur	162190	60	36	60.0
Total		3025	1806	59.7

Source : State of Environment, 1995, India.

There has been a significant increase in the generation of domestic, urban and industrial wastes in the last few decades. This is due to rapid population growth and industrialization. The problem of waste disposal from both domestic and industrial sources has become quite acute in some towns and cities, with disposal facilities lagging far behind the total quantity of wastes generated. Although, a major part of the waste generated is non-hazardous, substantial quantities of hazardous waste is also generated by industries, hospitals etc.

Leaching of hazardous wastes at dumping sites is not uncommon. This results in the contamination of surface and groundwater supply and is a potential risk to human health. Therefore, effective control of hazardous waste is of paramount importance for the maintenance of health, environmental protection and natural resource management.

In view of the proliferation of the chemical industry and the significant increase in hazardous waste generation, the ministry of Environment & Forest, GOI, framed the hazardous wastes (management and handling) Rules, 1989. These rules provide an effective inventorisation and controlled handling and disposal of hazardous wastes through voluntary disclosures by the industry. Under these rules, it is mandatory for hazardous waste generators to provide information on the quality and type of hazardous waste produced. The industries generating hazardous wastes are required to apply for authorization for handling hazardous wastes from the concerned state pollution control boards. In addition, they are required to maintain records and report the accidents.

TABLE 7.4.3 : COMPOSITION OF SOLID WASTES FROM CITIES

Cities	Characteristics (%)					
	Non-Degradable					Degradable
	Paper	Plastics	Metal	Glass	Ash & Earth	
Calcutta	3.18	0.65	0.66	0.38	34.00	47.00
Delhi	6.29	0.85	1.21	0.57	36.00	35.00
Nagpur	1.88	1.35	1.33	1.34	41.42	34.81
Bangalore	4.00	2.00		1.00	15.00	78.00
Mumbai	10.00	2.00	3.60	0.20	44.20	40.00

Source : India's Development Report, 1997

ABBREVIATIONS

ASI	Annual Survey of Industries
BSI	Botanical Survey of India
CEA	Central Electricity Authority
CFC	Chloro-Floro-Carbons
CO	Carbon Monoxide
CH_4	Methane
CPCB	Central Pollution Control Board
Cu.m	Cubic Metros
GWP	Global Warming Potential
GOI	Government of India
H_2S	Hydrogen sulphide
Ha	Hectares
HC	Hydro Carbons
IQ	Institutional Qualified
Kms	Kilometers
M.C.M	Million cubic meters
Mha	Million hectares
MOEF	Ministry of Environment and Forests
MW	Megawatts
NA	Not Available
Neg.	Negligible
NH_3	Ammonia
NIQ	Non-Institutional Qualified
NO_2	Nitrogen dioxide
NSFP	National Social Forestry Project
ODP	Ozone Depletion Potential
ppm	Parts per million
ppbv	Part per billion by volume
ppmv/year	Parts per million by volume per year
Pb	Lead
ppmv	Part per million by volume
pptv	Part per trillion by volume
Rs.	Rupees
SAR	Sodium absorption ratio
SFP	Social Forestry Project
SO_2	Sulphur dioxide
SPM	Solid Particulate Matter
RSPM	Residual Suspended Particulate Matter
Sq. Kms.	Square Kilometers
TDS	Total Dissolved Solids
TERI	Tata Energy Research Institute
WB	World Bank
ZSI	Zoological Survey of India

CONCEPTS AND DEFINITIONS OF THE TERMS USED

Area under miscellaneous tree crops, groves, etc. :

All culturable land which is not included under 'net area sown' but is put to some other agricultural use, such as land under casuarina trees, thatching grasses, bamboo bushes and other groves for fuel etc.

Barren and unculturable land :

Land which cannot be brought under cultivation unless at high cost, irrespective of whether such land is in isolated blocks or within cultivated holdings.

Crown cover :

The canopy formed by the crowns of all the trees in a forest or in an uneven aged forest by the crowns of all trees in a specified crowns class.

Culturable waste :

Land available for cultivation but not taken up for cultivation or abandoned after a few years for one reason or the other. Such lands may be either fallow or covered with shrubs and jungles not put to any use. These may be assessed or unassessed and may lie in isolated blocks or within cultivated during the year and the last five or more consecutive years in succession will be included in this category.

Current fallow :

Cultivable area kept fallow during the current agricultural year. Any seedling area in the current agricultural year not cropped in the same year is also treated as current fallow.

Demersal :

Refers to fish that live on or adjacent to the sea bottom.

Dense Forest :

Forests whose crown density is 40 percent or above.

Endangered :

Species in danger of extinction and whose survival is unlikely if the causual factors continue operating. Included are species whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Expectation of Life at Birth :

The Expectation of life at birth is defined as the average number of years expected to be lived at the time of birth if current mortality trends were to continue.

Extinct :

Species that are no longer known to exist in the wild after repeated searches of the type localities and other known or likely places.

Flush system latrine :

The type of latrine which is connected to an under ground sewerage system, from which human excreta and wastes are flushed out by water.

Forest :

Includes all actually forested area on the lands so classed or administered as forests under any legal enactment dealing with forests, whether state-owned or private.

Gross area irrigated :

An irrigated plot growing crop in more than one season, is counted as many times as it is cropped to arrive at gross area irrigated. In case of mixed crops, the area under component crops as reported by household is taken into account.

Habitat :

An area and not a particular location is called habitat. The site or environment which a plant or animal lives, such as forest.

Household :

A household is a group of persons who commonly live together and would take their meal from common kitchen unless the exigencies of work prevented any of them from doing so. There may be a household of persons related by blood or a household of unrelated persons or having a mix of both. Examples of unrelated households are boarding houses, messes, hostels, residential hotels, rescue homes, jails, ashrams, etc. These are called "Institutional Households".

Infant Mortality Rate :

Infant mortality rate is defined as the number of deaths under one year of age to thousand live births in a year.

Irrigation :

A device of purposely providing land with water other than rain water by artificial means.

Land put to non-agricultural uses :

Includes all land occupied by buildings, paths, etc. or under water (e.g. tank, canals etc.) and land put to uses other than agricultural production.

Neretic :

The part of the pelagic environment that extends from the nearshore zone out to depth of about 200 m; the water overlying the continental shelf related to shallow water on the margin of the sea, generally that overlying the continental shelf.

Net area irrigated :

The total of all the areas irrigated from different sources, counting each area irrigated only once even though it was irrigated more than once in the same year.

Net area sown :

Area sown with crops and orchards, counting the area sown more than once in the same year, only once.

The above definition was elaborated as follows:

The net area sown was defined as the difference between the total geographical area of all plots of land of the holding and the sum of the areas of land under

(1) forest, (2) barren & uncultivable wastes, (3) put to non-agricultural uses, (4) culturable wastes, (5) permanent pastures & other grazing land, (6) miscellaneous tree crops excluding orchards and (7) all type of fallow lands.

Open Forest :

Forest whose crown density is more than 10 percent but less than 40 percent.

Other fallow :

All lands which are taken up for cultivation in the past, but are temporarily out of cultivation for a period of not less than one year and not more than five years including the current agricultural year are classified under 'other fallow'.

Pastures and grazing land :

Include all grazing lands irrespective of whether they are permanent pastures and meadows or not. Grazing lands within forest area shall be included under this category.

Rare :

The species with small world populations that are not at present endangered or vulnerable but are at risk. These species are usually localised within restricted geographic areas or habitats or are thinly scattered over a more extensive range.

Room :

Covered space enclosed by walls on all sides reaching from the floor to the roof and having a door way. The rooms have been further classified as NBO rooms (specification for a room as recommended by the National Buildings Organisation)and other rooms. An NBO room is defined as a room having a floor space of at least four square metres and height of at least two metres from the floor to the ceiling.

Service latrine :

The types of latrine which are attended by the scavenging services of the Municipalities or Corporations .

Slum :

A slum is defined as an areal unit having twenty five or more katcha structures mostly of temporary nature, or fifty or more households residing mostly in katcha structures, huddled together, or inhabited persons with practically no private latrine and inadequate public latrine and water facilities.

Species :

A group of individual specimens having close resemblance but differing from others and belonging to the same genus.

Tap :

Source through which the drinking water is distributed through pipes laid out by corporations, municipalities or other local authorities like metropolitan or town development authorities or housing estates or similar agencies. But drinking water distributed through pipes by the house owner by pumping out from unprotected wells, tanks or springs should not be regarded as tap.

Type of dwelling :

Dwellings, have been classified under three categories, namely, chawl/bustee, independent house and flat.

(a) Chawl/Bustee :

A collection of poorly built katcha or semi-pucca huts or tenements.

(b) Independent house :

A separate structure with a room or rooms and having all its accessories and a separate entrance to it. In other words, if the dwelling unit and the entire structure of the building are physically coterminous, it should be considered an independent house.

(c) Flat :

All housing arrangements other than chawl/bustee and independent house are to be taken as flats. Flat thus includes any self-contained dwelling unit with a room or rooms provided with normal housing facilities like water supply, bath and latrine used exclusively by the family residing there or jointly with other families. It also includes detached room or rooms with or without other housing facilities.

Type of structure :

The structures have been classified into three categories, namely pucca, semi-pucca and katcha on the basis of the materials used for consideration.

(a) Pucca Structure :

A structure whose walls and roof at least are made of pucca materials.

(b) Katcha Structure :

A structure which has walls and roof made of non-pucca materials.

(c) Semi-Pucca Structure :

A structure which has either the walls or the roof, but not both, made of pucca materials. Walls/roof made partially of pucca materials will be regarded as katcha walls/roof. Materials such as oven-burnt bricks, stone, stone-blocks, cement, concrete, jack-board (cement plastered reed), tiles and timber are pucca materials. Corrugated iron or asbestos sheets used in the construction of roof will also be treated as pucca materials.

Urban :

The criteria adopted for treating the urban for 1991 census is:
All statutory towns, i.e., all places with a municipality, corporation, cantonment board or notified town area committee , etc.

(a) All places which satisfied the following criteria:

(i) A minimum population of 5000;

(ii) At least 75% of the male working population engaged in non- agricultural pursuits; and

(iii) A density of population of atleast 400 per sq. km. Mile (1000 per sq. mile).

Urban Agglomeration :

(i) A city or a town with a continuous outgrowth, the outgrowth being outside the statutory limits but falling within the boundaries of the adjoining villages ; or

(ii) Two or more adjoining towns with their outgrowths, if any, as in (i) above ; or

(iii) A city and one or more adjoining towns with or without outgrowths all of which form a continuous spread.

Vulnerable :

The species believed likely to move into the endangered category in the near future if the casual factors continue operating. Included are species of which most or all the populations are decreasing because of overexploitation, extensive destruction of habitat or other environmental disturbance; species with populations that have been seriously depleted and whose ultimate security is not yet assured; and species with populations that are still abundant but are under threat from serious adverse factors throughout their range.

REFERENCES

- ASI Summery Results : Central Statistical Organization Publication, 1988-89 .
- Asian Development Bank (1995) : Institutional strengthening and collection of Environment Statistics in selected developing member Countries (RETA 5555). Inception workshop Report 18-21 Sept. 1995. Tata Consultancy Services, Manila , Philippines.
- Central Pollution Control Board(1989) : Assesment of vehicular pollution in metropolitan cities. Control of Urban Pollution Series- G1/ 1988-89.CPCB, New Delhi.
- Central Pollution Control Board (1993 & 1994) : Water Quality – Status and Statistics
- Economic Survey 1996-97 : Department of Economic Affairs, Ministry of Finance.
- ESCAP (1995) : State of Environment Report for Asia and the Pacific Region. Bangkok, Thailand.
- Estimates of Poverty, Government of India. : Press Information Bureau, March, 1997.
- Extent, Composition Density, Growing Stock. And Annual Increment Of India's Forests(1995) : Forest Survey of India. Ministry of Environment and Forests
- Gopal Bhargava (1992) : Pollution and its control, Mittal Publications, New Delhi.
- Gopal Bhargava (1992) : Environmental Challenges and Ecological Disasters

- India Development Report (1997) : Indira Gandhi Institute of Development Research. Oxford University Press. Ed. Kirit S. Parikh.
- Inventory of Forest Resources of India(1996) : Forest Survey of India. Ministry of Environment and Forests.
- Peter, R.Cox (1972) : Population and Pollution, Academic Press, London.
- Poverty Population & Employment, 1996. : V . M. Dandekar
- Selected Socio-Economic, India, 1994. : Central Statistical Organisation Publication.
- State of Environment, India, 1995. : Ministry of Environment & Forests.
- T.N.Khoshoo (1991) : Conservation of Biodiversity in Biosphere. Ppm178-233. Indian Geosphere-Biosphere. National Academy of Sciences, Allahabad.
- T.N.Khoshoo (1994) : India's Biodiversity : Tasks Ahead. Current Science, 67(8) :577-82.
- TEDDY (1996/97) : Tata Energy Data Directory and Yearbook – 1990/1991, New Delhi: Tata Energy Research Institute.
- Tendulkar , S.D and Jain , L.R (1993) : Poverty in India . 1970-71 to 1988-89 ARTEP working papers ILO, New Delhi.
- The State of Forest Report (1995) : Forest Survey of India. Ministry of Environment and Forests.
- UNDP (1996) : Human Development Report
- United Nations (1988) : Concepts and methods for the development Of Environmrnt Statistics: Human Settlements Statistics – A Technical Report. Sales No. E 88.. XVII. 14.

- United Nations Environment Programme (1984) : The state of the Environment.
- United Nations Environment Programme (1997) : Global Environment Outlook
- United Nations (1991) : Concepts and methods of Environment Statistics Statistics of the Natural Environment – A Technical Report. Sales No. E91.XVIII.18.
- United Nations (1991) : Concepts and methods of Environment Statistics Statistics of the Natural Environment: A Technical Report, Department of International Economic and Social Affairs, Statistical Office, Series F, No. 57 , New York.
- Women & Men in India, 1995. : Central Statistical Organisation Publication.

METHODS OF MEASUREMENT OF AIR POLLUTION

Methods of measurement of air pollution followed by the Central Pollution Control Board are as follows:

A. Sulpher dioxide (SO_2)

The SO_2 is absorbed from air in a solution of potassium tetrachloromercurate(TCM). The resultant complex is made to react with pararosaniline and formaldehyde to form the coloured pararosaniline methylsulphunic acid, the absorbance of the solution is measured by means of a suitable spectrophotometer at 560 nm.

B. Nitrogen dioxide (NO_2)

The NO_2 in ambient air is collected by bubbling it through a solution of sodium hydroxide and sodium arsenate. The resultant nitrite ion concentration is colorimetrically determined by reacting it with sulfanilamide and N- (1-napthy)- ethylene diamine dihydrochloride, the absorbance is then measured at 540 nm.

C. Suspended Particulate Matter (SPM)

SPM is measured gravimetrically high volume sampling with whatman filter paper is used at average flow rate not less than 1.1 cubic meter per minute.

Source : Ambient Air Quality – Status and Statistics, 1995, Central Pollution Control Board, Delhi

METHODS OF DETERMINATION OF WATER QUALITY PARAMETERS

Parameter	Recommended Method
1 Temperature	Thermometeric method
2 pH	Electromatic method
3 TSS	Nephlometric method
4 Velocity of Flow	1) Current method 2) Float method 3) Chemical method
5 Dissolved Oxygen	Iodometric method
6 Biochemical Oxygen Demand	Dilution method
7 Total Kjeldahl Nitrogen	a) Digestion b) Distillation 1) Titration method (>5mg/1) 2) Nesslerization method (<5mg/1)
8 Nitrogen, nitrate + nitrite	Amalgamated Cadmium Reduction method for reduction of nitrate to nitrite by diazotisation method
9 Total Coliform (MPN)	Multiple Tube Dilution technique
10 Fecal Coliform (MPN)	Multiple Tube Dilution technique
11 Conductivity	Conductometric method
12 Chloride*	1) Argentometric method 2) Mercurimetric method
13 Hardness	EDTA Titrimetric method
14 Calcium	EDTA Titrimetric method
15 Magnesium	By difference of 13 & 14

Parameter	Recommended Method
16 Alkalinity	1) Electrometric method 2) Visual titration method
17 Sulphate**	Turbidimetric method
18 Sodium	Flame photometric method
19 Chemical Oxygen Demand	Dichromate reflux method
20 Total Dissolved Solids & 21 Fixed Dissolved Solids	Gravemetric method
22 Phosphate	Molybdate method (Colorimetry)
23 Boron	Curcumine method (Colorimetry)
24 Free Ammonia	

Source : Water Quality - Status & Statistics (1993 & 1994)
Central Pollution Control Board

* Argentometric method has been given first preference but if the colour of the sample interferes with the chromate end point then mercurimetric method should be used.

** Usually sulphate concentration is low in surface waters & hence gravimetric method may not be accurate as turbidimetric method, therefore, turbidimetric method is suggested.

Note : Wherever more than one methods are given, they are in order of preference.

A NOTE ON POVERTY ESTIMATION

The official estimates of the poverty line are based on calorie norm of 2400 per capita per day for rural areas and 2100 per capita per day for urban areas. The poverty line for the base year 1973-74 has been taken as the per capita expenditure level of which these calorie norms have been met, on an average, for the country as a whole, as per the National Sample Survey (NSS) household consumption expenditure survey for the corresponding year.

In order to arrive at the estimates of the number of poor, Planning Commission has been making adjustments in the NSS data on distribution of households by consumption expenditure levels. Such an adjustment has been felt to be necessary because the aggregate private household consumption expenditure as estimated from the NSS data is different from the aggregate private expenditure estimated in the National Accounts Statistics (NAS). Based on this methodology estimates of poverty have been made at national and state levels for the years 1972-73, 1977-78, 1983-84 and 1987-88.

In September 1989 in order to look into the methodology for estimation of poverty at National and State level and also to go into the question of redefining the poverty line, if necessary, the Planning Commission constituted an Expert Group on Estimation of Proportion and Number of Poor under the Chairmanship of Prof.D.K. Lakadwala. The Expert Group submitted its report in July, 1993.

The Expert Group has recommended (i)for giving up adjustment of the NSS data on the basis of the estimates of Private Consumption given in the NAS (ii) State specific poverty lines as against an All-India poverty line for rural and urban areas and (iii) use of the State Specific cost of living indices for up-dating the poverty line separately for rural and urban areas.

The full Planning Commission under the Chairmanship of the Prime Minister has decided to accept the Expert Group methodology for estimating poverty. However, whereas the Expert Group had recommended taking a simple average of the weighted commodity indices of "Consumer Price Index for Industrial Workers" and Consumer Price Index for Urban Non-Manual Employees" for estimating and updating urban poverty line, in a slight simplification of this method, the Planning Commission has decided to use only the "Consumer Price Index for Industrial Workers" for estimating and up-dating the urban poverty line.

ENVIRONMENT LEGISLATION, ACTS, RULES, NOTICIFICATIONS AND AMENDMENTS

General	The Environment (Protection) Act and Rules, 1986 The Environment Audit Notification, 1992 The Environment Standards Notification, 1993 The Environment Clearance Notification, 1994 The Public Liability Insurance Act, Rules, and Amendment, 1991, 1992 The National Environment Tribunal Bill, 1992
Land Use	The Ancient Monuments and Archaeological sites and remains Act, 1958 The Urban Land (Ceiling and Regulation) Act, 1976 The Model Regional and Town Planning and Development Law, 1985 Provision in State Acts on Town Planning The Industries (Development and Regulation) Act and Amendment,1951,1987 The Mines and Minerals (Regulation and Development) Act And Amendment, 1957, 1984
Water	The Coal Mines (Conservation and Development) Amendment Act, 1985 The Water (Prevention and Control of Pollution) Act, Rules and Amendment, 1977, 1978, 1992 The Coastal Regulation Zone Notification, 1991 The Oil Fields (Regulation and Development) Act, 1984 The Merchant Shipping Act, 1970
Air	The Indian Fisheries Act, 1987 The Air (Prevention and Control of Pollution) Act, Rules, and Amendments, 1981, 1982, 1983, 1987 The Factories Act and Amendment, 1948, 1987 The Motor Vehicles (Amendment) Act, 1986 The Atomic Energy Act, 1982 The Indian Boiler Act, 1923
Hazardous Chemical & Wastes	The Hazardous Wastes (Management and handling) Rules, 1989 Manufacture, Storage, and Import of Hazardous Chemicals Rules, 1989

Source : TEDDY, 1997/98 Tata Energy Research Institute

List of Papers presented in the National Workshop on Environment Statistics, held on 12 – 13 January, 1998 at Goa

1. Environment Statistics

i) Development of Environment Statistics in India- Status Paper by Shri R. L. Narasimhan, Director, Department of Statistics

ii) Environmental Indicators by Shri Harish Chandra, Joint Director, Central Statistical Organisation

iii) Monitoring Environment through Statistics by Dr. K. R. Satyamurthy, Deputy Commissioner, Central Ground Water Board

2. Environment, Population and Human Health

i) Inter-Linkages between population growth and status of environment by Dr. R. N. Pandey, Joint Director , Central Statistical Organisation

ii) Human Health and Environment by Shri Sumeet Saxena, Fellow, Tata Energy Research Institute

3. Status of Data Base On Bio-Diversity

i) Effort needed to measure Biodiversity by Dr. S. A. Paranjpe and Prof. A. P. Gore, Department of Statistics, Pune University

ii) Role of Zoological Survey of India in Estimation of Biolgical Resources by Dr. A. K. Ghosh, Project Director, Bio-diversity, Zoological Survey of India

iii) Agri-Biodiversity and its impact on Agricultural Production by Dr. S. P. Tiwari, Assistant Director General, Indian Council of Agricultural Research

iv) Statistical Assessment of Plant Diversity in India by Shri L. K. Banerjee, Botanical Survey of India

4. Status of data bases on different types of Pollution

i) Status of noise pollution in Calcutta and current State legal measures for abatement by Dr. S.C.Santra , School of Environmental Sciences , University of Kalyani

ii) Environmental issues in water resources projects; Implications of Environmental Data base by Shri A.K.Bhatia, Director, Information System, Central Water Commission

iii) Air and water pollution due to tanneries in Tamil Nadu by Dr. R.Bhaskaran, Director of Statistics, Govt. of Tamil Nadu

iv) Effects of Environmental pollution in Karnataka by Smt. A.S.Bhatt, Director & Shri M.Joseph Jaya Kumar, Joint Director, Directorate of Economics & Statistics, Govt. of Karnataka

v) Air pollution in India – An exploratory Study by Dr. Sunita Chitkara, Deputy Director, Central Statistical Organisation, New Delhi

vi) Off line method for parameter estimation in water quality modelling by Dr.A.P.Sargaokar, Scientist, National Environmental Engineering Research Institute, Nagpur

vii) Effect of salinity decline on zooplankton, community of Mahadayi river estuary by Indrani Gupta, Apurba Gupta, Scientist and Prof. P.Khanna, Director , NEERI

5. Status of Data base on Human settlements and its impact on other aspects of environment

i) Availabilty of Environmental data on Human Settlements through censuses by Dr. M.Vijayan Unni, Registrar General of India

ii) Growth in slums and major pollutant in Delhi by Dr.Attar Singh, Director, Directorate of Economics and Statistics, Delhi

iii) Housing conditions of service facilities available in slums, the NSS experience by Dr. V.Saha, Director, SDRD, NSSO

6. Status of Data base on Land and Soil and their degradation

i) Locating data gaps in planning strategies for micro level development of different rain fed areas by Dr. V.K.Bagchi, Indian Statistical Institute

ii) Soil and Land Resources data for catchment area treatment by Dr.S.N.Das, Chief Soil Survey Officer, All India Soil and Land Use Survey

iii) Land use Statistics , As an information system for environmental planning by Dr. G.S.Ram, Economic and Statistical Adviser, and Dr. Rajeev Mehta, Deputy ESA, Ministry of Agriculture

7. Natural Resource Accounting

i) Data base for physical accounting of forests review with a focus on the Yamuna Basin by Prof. Kanchan Chopra, Institute of Economic Growth

ii) Methodological Issues in Natural Resource Accounting by Prof. Amitabh Kundu, Director, Gujarat, Institute of Development Studies

iii) System of National Accounts and Environmental Accounting by Dr. A.C.Kulshrestha and Dr.Gulab Singh, Central Statistical Organisation

M – 12014/6/96 – ICT
Govt. of India
Ministry of Planning & Programme Implementation
Department of Statistics
Central Statistical Organization

Sardar Patel Bhawan
Sansad Marg, New Delhi.
The dated 5 November, 1996.

OFFICE MEMORANDUM

India has been selected as one of the member countries for implementing Asian Development Bank (ADB) project for the purpose of Institutional Strengthening and collection of environment statistics. The Central Statistical Organization. Department of Statistics, being the National Statistical Office has been designated as the implementing agency in India for the project. The activities spread over a period of three years will be quite intense and will require a high degree of involvement and commitment on part of the country. To ensure that the project is given high level support and cooperation from all concerned, it has been decided to constitute a Steering Committee with the following composition :

(1)	Dr. S. S. Srivastava Director General Central Statistical Organization S. P. Bhawan, New Delhi – 110001.	Chairman
(2)	Shri R. S. Ahlawat * Director Ministry of Environment & Forests Paryavaran Bhawan, C.G.O Complex, New Delhi – 110003.	Member
(3)	Dr. S.P. Chakraborty, * Member Secretary Central Pollution Control Board Parivash Bhawan, CBD – Cum office Complex, East Arjun Nagar, New Delhi – 110092.	Member

(4)	Shri Sanjay Srivastava, Director, National Building Organization, Ministry of Urban Areas & Employment, Nirman Bhawan New Delhi – 110011.	Member
(5)	Dr. M. Vijayanunni, Registrar General, India Office of Registrar General 2-A, Man Singh Road New Delhi – 110003.	Member
(6)	Shri Sunil Chakravorty Deputy Director, Forest Survey of India, 21, Subhash Marg, Dehradun-248006	Member
(7)	Cheif Executive Officer National Sample Survey Organization S.P. Bhawan, Sansad Marg, New Delhi – 110001.	Member
(8)	Dr. A. K. Yogi, Joint Director, Field Operation Division, National Sample Survey Organization, D-28, Subhash Marg, C- Scheme, Jaipur.	Member
(9)	Dr. S. N. Das Chief Soil Survey Officer, All India Soil and Land Use Survey Ministry of Agriculture, IARI Building, Pusa New Delhi – 110012.	Member
(10)	Dr. Usha Munshi, * Environmental Specialist, Tata Consultancy Services 1, Mangaldas Road, Pune – 411001.	Member

(11) Dr. T.N. Khoshoo, — Member
Subject Matter Specialist
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New Delhi – 110001.

(12) Dr. R. K. Pachauri, — Member
Director
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(13) Shri Mohan Das Palat — Member
Joint Secretary,
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Ministry of Rural Areas And Employment,
Block No. 11, Fifth Floor
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(14) Shri A. K. Dhar, — Member
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(15) Mrs. Minakshi Rajgopalan, — Member
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(16) Shri B. M. Nagrale, — Member
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(17) Shri Atar Singh, — Member
Director,
Directorate of Economics & Statistics
Govt of NCT, Delhi
Old Secretariate, Room No. 148
Delhi – 110054.

(18) Shri B. C. Kandpal — Member
Economic Advisor To the
Govt of Himachal Pradesh,
Directorate of Economics & Statistics,
Shimla – 171001.

(19) Director — Convener
(dealing with environment statistics)
Central Statistical Organization,
S.P. Bhawan, New Delhi – 110001.

* The Seering Committee Meetings were attended by Smt. Usha Ghosh, System Analyst of CPCB and Shri D. Bandhopadhaya, Additional Director, Ministry of Environment & Forests on behalf of their Organizations. Shri R. N. Khosla Group Leader & Environment Specialist represented Tata Consultancy Services in place Smt. Usha Munshi, who left the Organization.

The terms of referrence of the Steering Committee would be as under :

(i) Preparation of Framework for the Development of Environment Statistics,

(ii) Drawing a list of environment Statistics and Core Environment Indicators that can be compiled from the available basic information on natural resources use/depletion, soil, water and air quality, quality of life in population centers etc.

(iii) Compilation of Identified Statistics and Indicators based on the already available basic information for dissemination.

3. The Steerring committee can coopt any expert in environment statistics and may set up sub committee on various environmental concerns/areas, if considered necessary.

4. The TA/DA for non official member if any would be done by the Department of Statistics as applicable to the Grade I Officers of the Government.

5. This issues with the concurrence of Internal Finance Division vide their diary no. 409/ FA(stat) dated 10-10-96.

(D.S. Sethi)
Under Secretary to the Government of India
Tele No. 3747503

Copy forwarded to :

1. All Ministries/Department of Govt. of India
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5. All Directors in CSO and Head (NAD)
6. Directors, FOD, DPD, SDRD, NSSO & Executive Director Computer Centre
7. Pay & Accounts Officer, Department of Statistics, New Delhi.

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