COMPENDIUM OF ENVIRONMENT STATISTICS 2000

ENTRAL STATISTICAL ORGANISATION
NISTRY OF STATISTICS AND PROGRAMME IMPLEMENTATION
VERNMENT OF INDIA
Y DELHI

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OF

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PREFACE

In the new millenium the country faces new challenges. We have to continue to improve our economic growth rate, provide basic minimum life support services to a large section of population and deal with the problems of poverty and unemployment. At the same time we have to pay attention to conserving our natural resources and also improving the status of our environment. Environmental degradation, which was not much of a concern until quite recently, has started to accelerate, particularly in urban areas. We will need to tackle this in a holistic manner in order to ensure sustainability, both economically and environmentally. This, in short, is the task before the country, and in particular before the planners, policy makers and more associated with the implementation of remedial progress.

Although the issue of environment sustainability has formally entered the international agenda only after the Earth Summit, which was held in Rio de Janeiro in 1992, it has been an integral part of Indian planning and policy making for atleast two decades prior to that. Environmental protection and the conservation of natural resources emerged as key of National Priorities in India in the wake of 1972 Stockholm Conference on Human Environment. Between the Stockholm Conference and Rio Summit, India has been able to develop a suitable stable organizational structure for environment protection in the country. Policies and programmes have also evolved during the same period, geared to the task of protection of the environment.

To have a good understanding of our environment and to be able to understand the problem and mount appropriate preventive and timely corrective steps, it is imperative to build up a good data base on various aspects of the environment. The Central Statistical Organisation (CSO) being the nodal agency for development of the statistical system in India has paid increasing attention to this issue since the early eighties. The CSO has the benefit of constant interaction with academicians, researchers, various government and private organizations as well as international agencies and in 1997 came out with the first publication containing data on various aspects of environment namely "Compendium of Environment Statistics". Subsequently, it has been decided to bring out this publication on an annual basis. The present issue pertaining to the year 2000 is the fourth in the series.

In the current issue, all efforts have been made to update the old tables, wherever possible. As per the suggestions made in the Second National Workshop on Environment Statistics, 48 new tables have been added in various chapters so as to make this issue more comprehensive. Four tables have been added in the section pertaining to 'Forests', one in 'Fauna', two in 'Air and Transport', sixteen in 'Energy', seven in 'Industry', two in 'Agriculture', one in 'Natural Disasters', six in 'Ground Water' and nine in 'Waste Management'. In all, this issue consists of 194 tables.

The Ministry of Statistics and Programme Implementation had brought out an agenda paper on Development of Environment Statistics before the Workshop on Environment Statistics held during 6-7 April, 2000 at Hyderabad. As suggested by the eminent participants, the time series data on various aspects have been included in the present issue of the Compendium. The write-ups of various chapters have been revised substantially taking into account the latest development in the area. The CSO is thankful to all the agencies which have provided the data for the present edition. We look forward to their continued support in future as well.

The Compendium has been prepared under the able guidance of Shri Vishnu Kumar, DDG. The responsibility of preparation of tables and write-ups was shouldered by the team headed by Shri Harish Chandra, Director and comprising of Smt. Mamta Saxena, Deputy Director, Shri M.C. Sharma, Assistant Director , Shri M.P.Diwakar, Senior Investigator, Shri Lokesh Kumar and Shri Vijay Kumar both Senior Computors. It has always been the endeavour of the CSO to improve the quality of its publications. Therefore, any suggestions/comments regarding the contents, get up as well as the presentation of data would be welcome for improving the quality of its future editions.

K. V. IRNIRAYA,
Secretary
Ministry of Statistics and Programme Implementation,

New Delhi
1-2-2001

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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 has been followed in the present issue. The six parameters of the framework namely biodiversity (flora and fauna combined), atmosphere, land/soil, water, 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 Ministry of Statistics and Programme Implementation 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 five sections : Air and Transport ; Energy ; Industry, Greenhouse Gases and Noise. The section on Air and Transport gives the composition of the troposphere; Ambient Air Quality Standards and state of ambient air quality in some cities and towns. Ambient air quality in Delhi has also been given. The section on energy gives information on installed capacity of utilities; electricity generation and actual power supply position, different fuels used for cooking ; coal resources in India as well as its production; 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 Industries gives information on the number of registered industrial

establishments 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 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 statewise 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 damage due to supercyclonic storm have also been added. 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.

The chapter on Human Settlements is divided into four sections : Population and poverty ; housing, slums and basic facilities; urbanization; 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. Under the section on 'population and poverty' information on population totals, infant mortality rate, expectation of life at birth and population below the poverty line have been given. The section on housing, slums and basic facilities contains estimates of population in India, number of households, their size, number of rooms per housing unit, water supply system and toilet installation by rural and urban, homeless population, urbanization trends in India, slum population, housing shortage projected, percentage of population below poverty line, medical facilities under allopathy and Indian system of medicine & Homeopathy .

Due to rapid growth in urbanization, there is substantial increase in generation of various kinds of solid waste. When these waste are not collected and disposed off improperly, they create health hazards. Information on hazardous waste regulatory quantities, total amount of solid waste collected in some towns/cities and composition has been given under the section on Waste management. In this issue tables, for the first time, have been included on the type and quantities of different types of waste product generated in Delhi. Some tables on plastic wastes have also been included.

1. Based upon Survey of India Map with the permission of the Surveyor General of India.
2. The territorial waters of India extented to 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 (recognisation) act, 1971, but have yet to be verified.
4. The administrative head quarters of Chandigarh, Haryana and Punjab are at Chandigarh.

CHAPTER ONE

ENVIRONMENT AND ENVIRONMENT DEGRADATION

INTRODUCTION

The Environment can be defined as the physical surrounding of man of which he is a part and on which he is dependent for his activities like physiological functioning, production and consumption. His physical environment stretches from air, water and land to natural resources like energy carriers, soil and plants, animals and ecosystems. For urbanized man, a large part of his environment is man made. But, even then, the artificial environments (building, roads) and implements (clothes, automobiles) are the result of an input of both labour and natural resources. Commonly the term 'Environment' is restricted to ambient environment. In that view, the indoor environment (home, work place) is regarded as isolated piece of environment to be treated on its own terms.

The indoor environment usually is under the jurisdiction of the Public Health authorities. Health risks are mainly linked to space heating, cooking and lighting: low grade fuels, insufficient ventilation, and low or non-existing chimneys are often the main problems. Additionally, there may be problems connected with moist, light, incidence, hazardous substances from building materials, lacquers and paints. Problems with drinking water, sewage and waste are not linked to the dwelling as such, but rather due to a lack of appropriate infrastructure. Statistics on indoor environment may be regarded as a subset of statistics on human settlements and the urban environment.

1.1 DEVELOPMENT VERSUS ENVIRONMENT DEGRADATION

Development activities are measured in terms of national products which in turn are defined as production of goods and services during accounting period. However, certain environmental functions which are crucial for economic performance and generation of human welfare such as provision of natural resources to production and consumption activities, waste absorption by environmental media and environmental services of life support and other human amenities, are taken into account only partly in conventional accounts. The scarcities of natural resources now threaten the sustained productivity of the economy and economic production and consumption activities. These activities impair environmental quality by over loading natural sinks with wastes and pollutants. The private and social costs of the use of the natural resources and the degradation of the environment may be taken into account for the sustainable development in the conventional accounts.

TABLE 1.1.1 : SOME IMPACTS OF DEVELOPMENT ACTIVITIES ON ENVIRONMENT

Development activities	Major impacts on environment
Forest clearing and land resettlements	Extinction of rare species of flora and fauna, creation of condition for mosquito breeding leading to infectious diseases such as malaria, dengue etc.
Shifting cultivation in upland agriculture	Soil erosion in upland areas, soil fertility declines due to shorter cultivation cycle which is practiced due to population pressure, flooding of low land areas. The problems could be resolved by terraced cultivation.
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 strains of fungus, bacteria or virus on new variety
Use of pesticides	Organism 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 environment problems. The pesticides used in agriculture sometimes go into food chain or in water bodies and as such results in harmful health hazards.
Timber extraction	Degrades land, destroys surface soil, reduces production potential of future forests.
Urbanisation and industrialization	Concentration of population in urban centers make huge demands on production in rural areas and put pressures on land, air and water pollution.
Water resource projects, e.g. Dam, disextensive irrigation	Human settlement and resettlement, spread of water born eases, reduction of fisheries, siltation, physical changes e.g. temperature, humidity.

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 fuel like coal in power plants and oil by vehicles
Suspended particulate matter	Smoke from domestic, industrial and vehicular sources.
Oxides of nitrogen	Fuel combustion of 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

1.2 EMISSIONS, DISCHARGES AND THEIR SOURCES

The environmental stress caused by developmental activities emanates 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 and continents	Over marine water	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 mining or agriculture.	Eutrophication Acidification Environment Contaminants Radio–activity	Changes of the climate due to ozone depletion and the greenhouse effects.

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 fuel like coal 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 per cent 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 discharge 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.

TABLE 1.2.3 : POLLUTANTS AND THEIR RELATED HEALTH HAZARDS

Pollutants	Health effects
Carbon Monoxide (from gasoline cars, 2-effects central wheelers, 3-wheelers) of blood	Fatal in large does: aggravates heart disorders; nervous system; impairs oxygen carrying capacity
Nitrogen Oxides (NO_x) (from diesel vehicles)	Irritation of respiratory tract
Ozone	Eye, nose and throat irritation; risk asthmatics, children and those involved in heavy exercise
Lead (from petrol vehicles)	Extremely toxic: effects nervous system and blood; canimpair mental development of children; causes hypertension
Hydrocarbons (mainly from 2-wheelers and 3-wheelers)	Drowsiness ,eye irritation, coughing
Benzene	Carcinogenic
Aldehydes	Irritation of eyes, nose and throat, sneezing, coughing, nausea, breathing difficulties; carcinogenic in animals
Polycyclic Aromatic Hydrocarbons PAH (from diesel vehicles)	Carcinogenic

CHAPTER TWO

DEVELOPMENT OF ENVIRONMENT STATISTICS IN INDIA

INTRODUCTION

India's development objectives reflected in our planning process has consistently emphasised the necessity of promoting policies and programmes for economic growth and social welfare. Consequently alleviation of poverty and development of the country's economic and social infrastructure has been emphasised and re-emphasised in the country's succeeding Five Year Plans. Investment resources were targetted to ensure realisation of these concerns. Environmental issues which have been for a long time part of Indian thought and social processes are reflected in the Constitution of the Republic of India adopted in 1950. The Directive Principles of State policy, an integral and significant element of our democratic order, contain provisions which reflect the commitment of the State to protect the environment with regard to forests and wildlife. The Directive Principles of State Policy enjoin upon the citizens of India, the special responsibility to protect and improve the environment. The roots of the growing trend towards popular participation in our conservation and natural resource development programme lie in this constitutional requirement. The foundations of the present day organisational framework for environmental programmes in India, go back to the 1970s with the establishment of the National Committee of Environmental Planning and Coordination by Smt. Indira Gandhi, former Prime Minister almost immediately after the historic Stockholm Conference on Environment held in 1972. The Committee was gradually to evolve into a Department of Environment in 1980 and five years later to a fulfledged Ministry of Environment and Forests(MOEF) of the Government of India(GOI). The State Governments also followed this example by establishing their own Departments of Environment to address the rapidly increasing policy initiatives and programmes in the environment and forest sectors.

India too, following the footsteps of other developed countries, set up a separate Ministry of Environment and Forests in the early nineties 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 multi-disciplinary subject involving complex subject like Bio-diversity, Atmosphere, Water, Land and Soil and Human Settlements, it seemed difficult to collect, analyse and study relationships among them. It therefore, became necessary to develop an efficient statistical system on environment that could meet the growing demand of various governmental agencies, environmentalists and general public for data on various aspects of environment.

Setting up of Environment Statistics Unit in Central Statistical Organisation

Recognising the importance of Environment Statistics as an emerging area, the subject was first discussed in the fifth Conference of Central and State Statistical Organisation (COCSSO) held at New Delhi in 1981. The Conference recommended the need for developing an appropriate environment statistical system in the country. The subject was again discussed in the Sixth and Seventh COCSSO. On the recommendation of the Seventh Conference of CSSO held in 1985, a multidisciplinary working group comprising Department of Environment, Central Statistical Organisation (CSO), State Directorate of Economics and Statistics, and other concerned Central and State organisation and research institutions involved in the related subjects was set up in CSO under the Chairmanship of DG, CSO in July, 1986. The Working Group in its Report submitted in 1990 suggested a provisional list of variables for Framework for Development of Environment Statistics. The group also suggested a few variables on which data needed to be collected on priority basis.

During the second half of 1996, a Steering Committee on Environment Statistics under the chairmanship of Director General, Central Statistical organization was constituted. In its first meeting held in January, 1997, a draft framework for the development of environment statistics was discussed along with the table formats to be used for preparing the compendium. The data source agencies were identified and it was decided to hold a workshop cum second meeting of the Steering Committee to discuss draft compendium of environment statistics. The workshop cum second meeting was held at Pune in March, 1997. Nine papers relating to various issues of Environment were presented in the workshop. As per the recommendations of the second meeting, the draft compendium was modified and finally got approved in the third meeting of the Steering Committee held in August, 97.

Compendium of Environment Statistics

The Central Statistical Organisation brought out three issues of the publication "Compendium of Environment Statistics" for the years 1997, 1998 and 1999 after compiling the available data relating to environment in the country. It is an effort to collect Statistics related to different factors that are affecting our environment. Although, the compendium is not an end in itself, it does provide a glimpse of the present scenario of the environmental degradation, its causes and the reasons for concern. It provides the necessary base to bring out the magnitude of the problem. The compendium consists of seven chapters. The first two chapters give a general introduction to environment, its degradation through different sources and their impact on human health and the development of environment statistics in India. The remaining five chapters are on Biodiversity, Atmosphere, Land/soil, Water and Human Settlements. The chapters are further divided into sections. The statistical data has been presented in the form of tables. Suitable graphs, charts and photographs have been added.

National Workshop on Environment Statistics

To disseminate information on the development of environment statistics in India and provide a forum for interaction between users and producers, two National Workshops on Environment Statistics have been organised. The first one was organized in Goa during 12-13 January 1998 and the second one was organized at Hyderabad during 6th-7th April, 2000. Both the workshops were attended by academicians, data users, and data producing agencies. They had seven technical sessions where more than 20 papers were presented. The sessions focussed on different aspects

of the environment such as environment statistics, population and human health, status of databases on different type of pollution, status of data bases on human settlements and impacts on other aspects of the environment; status of data base on land and soil and degradation; and natural resource accounting. Proceedings of both the National Workshops have been brought out in the book form by the CSO. The workshop made several recommendations some of which are as follows :

i) Conduct of similar workshops at the regional level by involving state departments of environment, forests, pollution control boards and other local level organisation for database development;

ii) Continued publication of the Compendium on Environment Statistics at regular intervals, increased interaction between data producers and users to improve the coverage of the publication and production of similar publications at the State level;

iii) Strengthening of the Environment Statistics Unit and expansion of membership of the Steering Committee on Environment Statistics to include other data source agencies and academic users, and establishment of linkages with the Environmental Information System (ENVIS) of the Ministry of Environment and Forests (MOEF) for database development and maintenance;

iv) Development of sound statistical methodologies for estimation of generic, specific, and ecosystem biodiversities; and

v) More frequent interactions (in the form of training courses and seminars/workshops) between statisticians and environmental scientists to clarify concepts and definitions as well as methodologies used in environment statistics and formation of small technical committees within CSO composed of representatives of the offices dealing with environment and statistics to identify new data to be included in the Compendium, standardize concepts and definitions of terms, etc.

A similar Third Workshop is planned in the last quarter of the year 2000 - 2001 at Thiruvananthapuram.

Training on Environment Statistics

Environment statistics being a multi disciplinary subject, the Statisticians working both at the Centre as well as State Governments are not fully familiar with the relevant terminologies and concepts. To fulfil this need, Department has organized two week International Training Programme on Environment Statistics with financial support from Asian Development Bank. Twenty-two participants from South and South East Asia including nine from India participated in this programme. The 2nd such training programme has been organized at Hyderabad during 4th-15th Dec. 2000. Some short duration training courses of say 1 to 2 weeks are needed to familiarise them with the subject and Central Statistical Organisation can associate specialised research institutions/universities in this effort. In addition, some specialised courses of medium duration say one to three months duration as well as exposure to international scenario may also be needed to develop expertise in these areas.

Liaison with International Organisations

Central Statistical Organisation continued its liaison with international organizations such as ESCAP, Asian Development Bank , United Nations Statistics Division (UNSD) and United Nations Environment Programme (UNEP). It also participated in the first phase of the ADB's Regional Technical Assistance on Institutional Strengthening and Collection of Environment Statistics alongwith other

Bank's Developing Member Countries. Officers of the Department of Statistics participated in all activities including the concluding workshop held in May 1998 at Manila by Shri R. L. Narasimhan, Deputy Director General. Shri C. R. C. Mohanty, Programme Specialist, EAP-AP, Bangkok visited in October 1999 and made a presentation on the activities of UNEP to the senior officers of the Department and also participated in the meeting of the Data Source Agencies called for assessment of data availability of UNEP Environmental Information Database held on 20th October 1999. The Department supplied the data on the UNSD questionnaire on Environmental Indicators. Shri Harish Chandra, Joint Director, Central Statistical Organisation participated in the Expert Group meeting on Environment Statistics and Indicators organized by UNSD during 27 September- 1 October 1999 at New York.

Natural Resource Accounting in Goa

In environmental-economic accounting system, increasing emphasis should be given on the natural environment that has been or could be affected by human activities. The assets of natural environment that are directly or indirectly, actually or potentially affected by human activities are called natural assets. Natural assets consist of biological assets (produced or wild), land and water areas with their ecosystems, subsoil assets and air. To develop such an environmental-economic accounting system, it is necessary to maintain natural resource accounts. However, no such system has been developed so far due to the lack of proper methodology.

The economic development of a country or region is generally expressed in terms of the growth of its income. The value of the final product excluding the value of inputs used in the process of production is termed as the Gross National Product (GNP). However, these indicators of economic development do not take into account the use and depreciation of the renewable or non-renewable natural assets. But the growing scarcity of these resources has forced the policy-makers to develop the natural resource accounts. Following other countries, India too has given due thought to this phenomenon and initiated a pilot project on Natural resource Accounting in Goa. After the development of a suitable methodology, It may be extended to other states as well as so as to arrive at an overall estimate for the country. A Technical working Group on Natural Resource Accounting has been constituted in the Department of Statistics & Programme Implementation and the first meeting took place on 19 November 1997. Following the deliberations a concept paper was got developed which was considered by the Technical Working Group in its meeting held on 23 September 1998. The Group has recommended that scope of study would be to cover all sectors of the economy, however, the major emphasis will be given to Forests and Biodiversity, Mineral, Marine Resources, Tourism and Energy. The project team headed by Tata Energy Research Institute would include marine biologist and tourism expert and the team would implement the project in two phases. In the first phase, the Natural Resource Accounting will be attempted with the available secondary data and identify the gaps and requirement of additional primary data to be collected. The first phase started in April 1999 was of ten months duration and total project is expected to be completed in two and half years. The project is being implemented by TERI under close supervision of Directorate of Planning, Statistics and Evaluation, Government of Goa. TERI has submitted its draft report on the first phase of this project. The report was considered by the sub-group in its meeting held on 25th January, 2001 and as it requires major revision, TERI was given four months time to revise the report.

CHAPTER THREE

BIODIVERSITY

The term 'biodiversity' encompassses the variety of life on Earth. It is defined as the variability among living organisms and the eccological complexes of which they are part, including diversity within and between species and ecosystems. Biodiversity manifests at species genetic and ecosystem levels. Biodiversity has direct consumptive value in food, agriculture, medicine, industry etc. It also has aesthetic and recreational value.

India is one of the 12 mega-biodiversity countries of the world. From about 70% of the total geographical area surveyed so far, 46,000 plant species and 81,000 animal species representing about 7% of the world's flora and 6.5% of the world's fauna respectively have been described. Out of the total twelve biodiversity hot spots in the world, India has two, one is the north east region and other the western ghats.

Plant biodiversity as a national and global resources is extremely valuable but is poorly understood, inadequately documented and often wasted . The preservation of biodiversity is both a matter of investment and insurance to (a) sustain and improve agricultural, forestry and fisheries production, (b) act as a buffer against harmful environmental changes , (c) provide raw materials for scientific and industrial innovations, and (d) safe guard transferring biological richness to future generations.

Biodiversity the world over is in peril because the habitats are threatened due to such development programmes as creation of reservoirs, mining, forest clearing laying of transport and communication networks etc. It is estimated that in the world wide 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.

Conservation Measures

Biospheres :

Areas rich in biodiversity and encompassing unique and representative ecosystems are identified and designated as Biosphere Reserves. The goal is to facilitate conservation of representative landscape and India's immense biological diversity as described above. Till date 12 Biosphere Reserves have been set up the last one being set up on 7.2.2000 at Kanchanjanga hills and Sikkim.

Project Tiger

As per the recommendations of a special task-force of the Indian Board of Wildlife, Project Tiger was launched in 1973 with the following objectives:-

- To ensure maintenance of available population of tiger in India for scientific, economic, aesthetic, cultural and ecological value.
- To preserve, for all times, the areas of such biological importance as a national heritage for the benefit, education and enjoyment of the people.

At present, there are 25 Tiger Reserves spreading over in 14 states and covering an area of about 33,875 sq. kms. The population of tigers is estimated through tiger census conducted once in 4 to 6 years. The last such census was conducted in 1997.

National Parks and Wild life Sanctuaries

The Wild Life Act provided for setting up National parks and sanctuaries for wild life. The basic idea in trying to encourage wild life .is that human welfare is initially 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.

Multipronged pressures on forests come from population, cattle grazing, fuel and fodder collection, industry and forest fires, etc. The remaining good forest cover is, therefore, estimated to be just 11% against the desirable 33% of the total land area as per the National Forest Policy. Up to the late seventies, forest land was a prime target for diversion for resettlement, agriculture and industrialization, and this trend was contained only by the Forest (Conservation) Act, 1980.

A two pronged strategy to increase forest cover essentially comprises of

- Improve canopy cover in the forest land; and
- Undertake afforestation in non-forest and degraded lands preferably contiguous to forest blocks.

Realising the role of forests in controlling soil erosion, moderation of floods, recharging of ground aquifers, as habitat for wildlife, conservation of bio-diversity and gene pool, etc., programmes were launched as early as the Second Five Year Plan for extensive Watershed Management followed later by establishment of a Protected Areas Network, under the Wildlife (Protection) Act, 1972, comprising of Biosphere Reserves, National Parks and Sanctuaries- both terrestrial and aquatic. This Network in 1999 comprised of 12 Biosphere Reserves, 89 National Parks, 504 Sanctuaries, along with such dedicated conservation programmes as Project Tiger, Crocodile Rehabilitation and Project Elephant. The Central Zoo Authority caters to the ex-situ conservation of wildlife through 275 zoos, deer parks, safari parks and aquaria, etc. India is a also signatory to several International Conventions like CITES, International Whaling Convention (IWC); Convention on Migratory Species (CMS), World Heritage Convention (WHC), etc. India has recently taken the lead in the formation of the Global Tiger Forum.

AGRO BIODIVERSITY

The National Bureau of Plant Genetic Resources (NBGR) established in 1976 as an institution under Indian Council of Agricultural Research (ICAR) emerged as an important organization dealing with various establishments of plant genetic resources. The organization is entrusted with the vital responsibility of germ plasm, exchange with appropriate quarantine measures, survey exploration, their organization, planning and coordination, comprising evaluation, documentation and conservation of diverse plant genetic resources. The National Gene Bank has also been established within the complex. Within the new trade related intellectual property rights (TRIPS) within World Trade Organisation related agreements, documentation of our genetic resources is very important. Similarly, the documentation of fish genetic resources is the responsibility of National Bureau of Fish Genetic Resource, Lucknow also an institution under ICAR. Similarly, the National Bureau of Animal Genetic Resources located at Karnal maintains the germ plasm of Indian Cattle and Buffalo breeds. This organization is also an institution of ICAR umbrella.

TABLE 3.1.1 : NUMBER AND STATUS OF PLANT SPECIES IN INDIA

Type	No. of known Sepices in the World	No. of known Sepices in India	Percentage of Occurrence in India	No. of Sepices Endemic	No. of Sepices Endangered	No. of Sepices Extinct
A. **Flowering Plants**						
Gymnosperm	650	48	7.38	8*	7*	..
Angiosperm	250000	17500	7.00	5775*	1700*	21
B. **Non-flowering Plants**						
Fern & Fernallics	10000	1200	12.00	193*	113*	..
Algae	40000	6500	16.25	1100*	120*	..
Fungi	70000	14500	20.71	4000*	140*	..
Lichens	13500	2021	14.97	417*	400*	..
Liverworts	7500	845	11.26	260*	100*	..
Mosses	7000	1980	28.28	243*	115*	..

Source : Botanical Survey of India, Calcutta.

* Approximate .. Not Known

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 causes the decrease of Natural habitats, which further results in the loss to biological diversity. Biodiversity, once lost cannot be recovered.

Nardostachys Jatamansi - a threatened medicinal plant

TABLE 3.1.2 : RARE AND THREATENED SPECIES (VASCULAR PLANTS)

Category	Approximate Number
Rare	287
Vulnerable	167
Endangered	1366
Possibly Extinct	40
Extinct	21

Source : Botanical Survey of India, Calcutta.

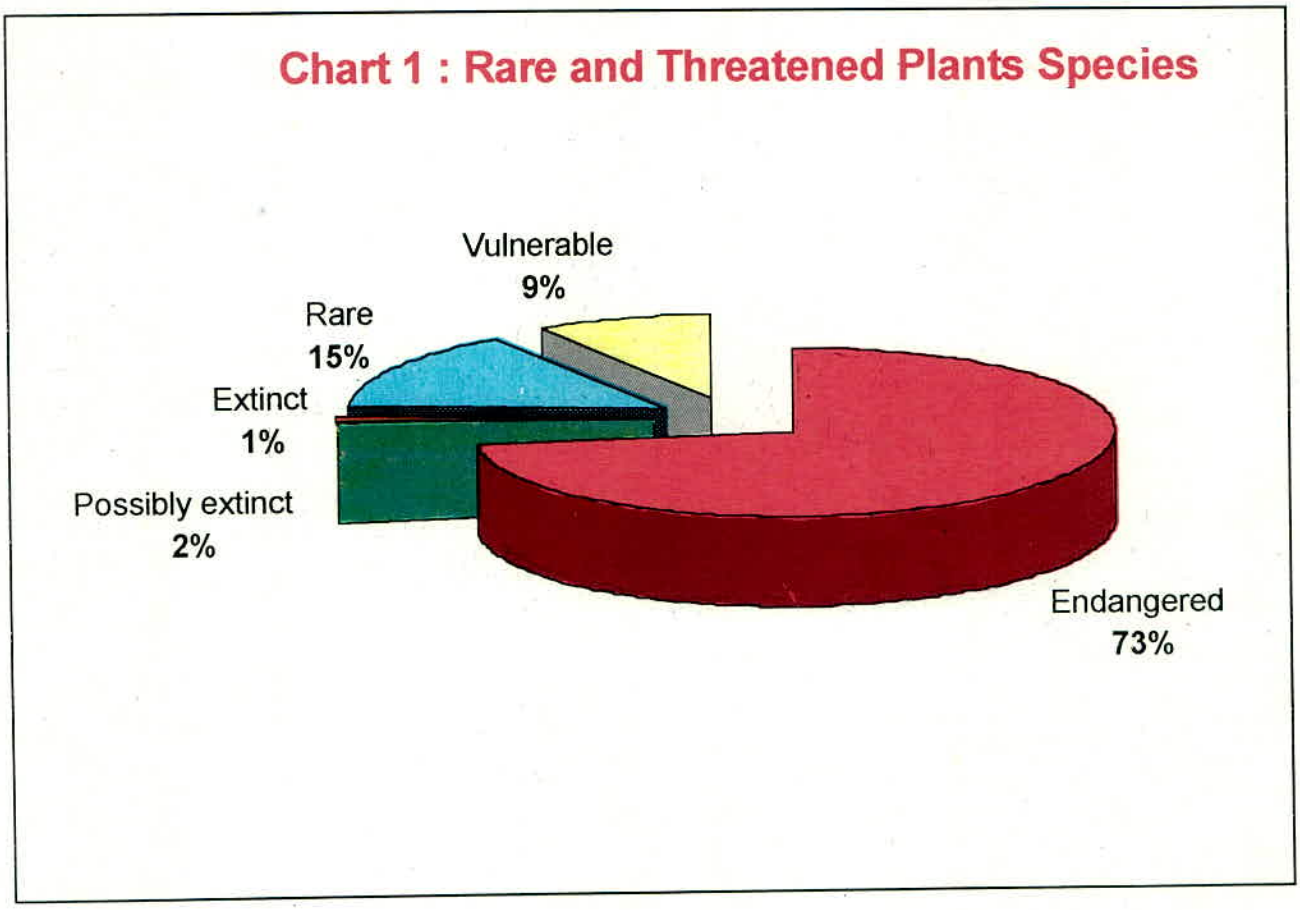

TABLE 3.1.3 : REFERENCE COLLECTIONS OF FLORA

	Category	Total Number	Total Holdings of Collections and Specimens
1	Herbarium	59	4594795
2	Museums	18	60100

Source : Botanical Survey of India, Calcutta.

TABLE 3.1.4 : CONSERVATION MEASURES

	Category	Number	Total Geographical area (Sq. Kms.)
A.	**Within Habitats (in situ)**		
(I)	Biosphere Reserves	12	33067
(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.

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TABLE 3.1.5 : NAMES OF BIOSPHERE RESERVES IN INDIA SETUP UPTO MARCH, 2000

S.No.	Name of Biosphere reserve	Date of setting up	Location (State)
1	Nilgiri	01.8.1986	Part of Wynad, Nagarhole, Bandipur and Madumalai, Nilambur Silent Valley and Siruvani hills (Tamil Nadu, Kerala and Karnataka)
2	Nanda Devi	18.1.1988	Part of Chamoli, Pithoragarh & Almora Districts (Uttrakhand)
3	Nokrek	01.9.1988	Part of Garo Hills (Meghalaya)
4	Great Nicobar	06.1.1989	Southern Most Islands of Andaman and Nicobar Islands
5	Gulf of Mannar	18.2.1989	Indian part of Gulf of Mannar between India and Sri Lanka (Tamil Nadu)
6	Manas	14.3.1989	Part of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamprup and Darang Districts (Assam)
7	Sunderbans	29.3.1989	Part of Delta of Ganges & Brahmputra rivers system (West Bengal)
8	Similipal	21.6.1994	Part of Mayurbhanj District (Orissa)
9	Dibru Saikhowa	28.7.1997	Part of Dibrugarh and Tinsukhia Districts (Assam)
10	Dehang Debang	2.9.1998	Part of Siang and Debang Valley in Arunachal Pradesh
11	Panchmarhi	3.3.1999	Part of Hoshangabad, Betul and Chindwara Districts (Madhya Pradesh)
12	Kanchanjanga	7.2.2000	Parts of Kanchanjanga Hills and Sikkim

Source: Ministry of Environment and Forests, Annual Report 1999-2000

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TABLE 3.1.8 : STATUS OF CRYOPRESERVATION OF SEED GERMPLASM

(As on 31st March, 2000)

Crops/Crops Groups	Plant Species	No. of Accessions
Orthodox Seeds		
Cereals and millets	Eleusine, Fagopyrum, Oryza, Panicum, Paspalum, Penniasetum, Triticum and Zia	210
Pulses	Cicer, Phaseolus, Vigna, Rhyncosia	117
Vegetables	Abelmoschus, Allium, Daucus, Lycopersicon, Pisum, Solamum	254
Horticultural crops	Citrus, Cucumis, Musa, Pyrus	41
Spices and condiments	Caram, Coriander, Elettaria	59
Medicinal and aromatic plants	Andrographis, Anethum, Chicorium, Catharanthus, Digitalis, Foeniculum, Mentha, Ocimum, Papaver	367
Oilseed crops	Brassica, Eruca, Sesamum	208
Arid/Semi-arid spices	Salvadora, Aegle, Carissa, Zizyphus, Phyllanthus	20
Recalcitrant/ Intermediate Seeds		
Tea	Camellia sinensis	85
Jackfruit	Artocarpus heterophyllus	3
Almond	Prunus amygdalus	17
Neem	Azadirachta indica	197
Cardamom	Elettaria cardamom	2
	Total	**1580**

Source : National Bureau of Plant Genetic Resources.

TABLE 3.1.9 : STATUS OF CRYOPRESERVATION OF POLLEN

(As on 31st March, 2000)

Plant Species	No. of Accessions
Brassica sp. (oleracea, napus, campestris, carinata, juncea, nigra)	43
Camellia sinensis	1
Cicer microphyllum	1
Citrus sp.	4
Eruca sativa	2
Raphanus satives	4
Sesamum sp.	1
Zea mays & allied genera	9
Total	**65**

Source : National Bureau of Plant Genetic Resources

TABLE 3.2.1 : STATE/UT WISE FOREST AREA

(Area in sq.km)

S. No.	State/Uts	Geographic area	Reserved forest	Protect-ed forest	Un-classed	Total forest	% of forests to 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.	Delhi	1483	78	7	0	85	5.73
6.	Goa	3702	165	0	1259	1424	38.47
7.	Gujarat	196024	13819	997	4577	19393	9.89
8.	Haryana	44212	247	1104	322	1673	3.78
9.	Himachal Pradesh	55673	1896	31473	2038	35407	63.60
10.	Jammu & Kashmir	222235	20182	0	0	20182	9.08
11.	Karnataka	191791	28611	3932	6181	38724	20.19
12.	Kerala	38863	11038	183	0	11221	28.87
13.	Madhya Pradesh	443446	82700	66678	5119	154497	34.84
14.	Maharashtra	307690	48373	9350	6119	63842	20.75
15.	Manipur	22327	1463	4171	9520	15154	67.87
16.	Meghalaya	22429	981	12	8503	9496	42.34
17.	Mizoram	21081	7127	3568	5240	15935	75.59
18.	Nagaland	16579	86	507	8036	8629	52.05
19.	Orissa	155707	27087	30080	17	57184	36.73
20.	Punjab	50362	44	1107	1750	2901	5.76
21.	Rajasthan	342239	11585	16837	3278	31700	9.26
22.	Sikkim	7096	2261	285	104	2650	37.34
23.	Tamil Nadu	130058	19486	2528	614	22628	17.40
24.	Tripura	10486	3588	509	2196	6293	60.01
25.	Uttar Pradesh	294411	36425	1499	13739	51663	17.55
26.	West Bengal	88752	7054	3772	1053	11879	13.38
27.	Andaman & Nicobar Islands	8249	2929	4242	0	7171	86.93
28.	Chandigarh	114	31	0	0	31	27.19
29.	Dadra & Nagar Haveli	491	198	5	0	203	41.34
30.	Daman & Diu	112	0	0.7	0	1	0.63
31.	Lakshadweep	32	0	0	0	0	0.00
32.	Pondicherry	493	0	0	0	0	0.00
	Total	3287263	416547	223321.7	125385	765253	23.28

Source : Forest Survey of India, The State of Forest Report 1999

India has 76.52 million hectares of recorded forest area. This accounts for 23.28% of total geographic area. Per Capita availability of forest in India is 0.08 ha which is much lower than the world average of 0.08 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 3.1.6 : STATUS OF EX-SITU CONSERVATION (BASE COLLECTION) OF ORTHODOX SEEDS, AT 20° C

(As on 31st March, 2000)

Crop Group	No. of Accessions
Cereals & Pseudo Cereals	90456
Millets & Minor millets	16935
Fibre crops	6755
Oil seeds	25015
Pulses	31856
Forage, Narcotics & Genetic Stocks	1029
Vegetables, Fruits & Spices	10990
M & AP	689
Released varieties	1320
Duplicate Safety Samples	10146
Total	**195191**

Source : National Bureau of Plant Genetic Resources

TABLE 3.1.7 : STATUS OF IN-VITRO CONSERVATION

(As on 31st March, 2000)

Crops	Storage Temp. (°C)	Optimum Subculture interval (months)	No. of accessions on culture.
Tuber/Bulb Crops			
Allium sativum	25, 4	16-20	97
Allium spp.	4,10,25	12-22	14
Alocasia Spp.	25	10	1
Colocasia esculenta	25	8-10	30
Dioscorea Spp.	25	12	40
Ipomoea Batatas	25	12	260
Xanthosoma sagitifolia	25	10	3
Spices & Industrial Plants			
Curcuma Spp.	25	6-10	51
Elettaria Spp.	25	15	5
Fagara schinifolia	25	6	1
Humulus lupulus	25	—	8
Piper Spp.	25	10-22	7
Vanilla Planifolia	25	6	5
Simmondsia chinensis	25	6	10
Zingiber Spp.	25	8-24	150
Fruits			
Actinidia chinensis	25	8	3
Ananas Spp.	25	8	4
Musa Spp.	25	8-12	315
Fragaria spp.	25	8-10	20
Prunus sp.	25	4	1
Rubus spp.	25	8-10	5
Medicinal /Aromatic Plants			
Bacopa monneierii	25	—	1
Coleus forskohlii	25	9-18	8
Digitalis spp.	25	8	5
Eremostachys superba	25	—	2
Gentiana Kurroo	4,10,25	11-16	1
Kaempferia galanga	25	18	4
Mentha Sp.	25	12	22
Pelargonium Spp.	25	4	3
Picrohiza Kurroa	4,10	16	1
Pogostemon patchouli	25	11-18	2
Pycanthemum spp.	25	—	4
Rauvolfia serpenpina	15, 25	15-22	6
Ravolfia canescens	25	22	1
Rhemum emodi	10	6	1
Rhemum moorcroftianum	10	6	1
Saussurea lappa	4,10	13-15	2
Tylophora indica	10,25	12-15	2
Valeriana wallichii	25	12	4
Total			**1100**

Source : National Bureau of Plant Genetic Resources

Mangroves - CAS Parangipetai

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

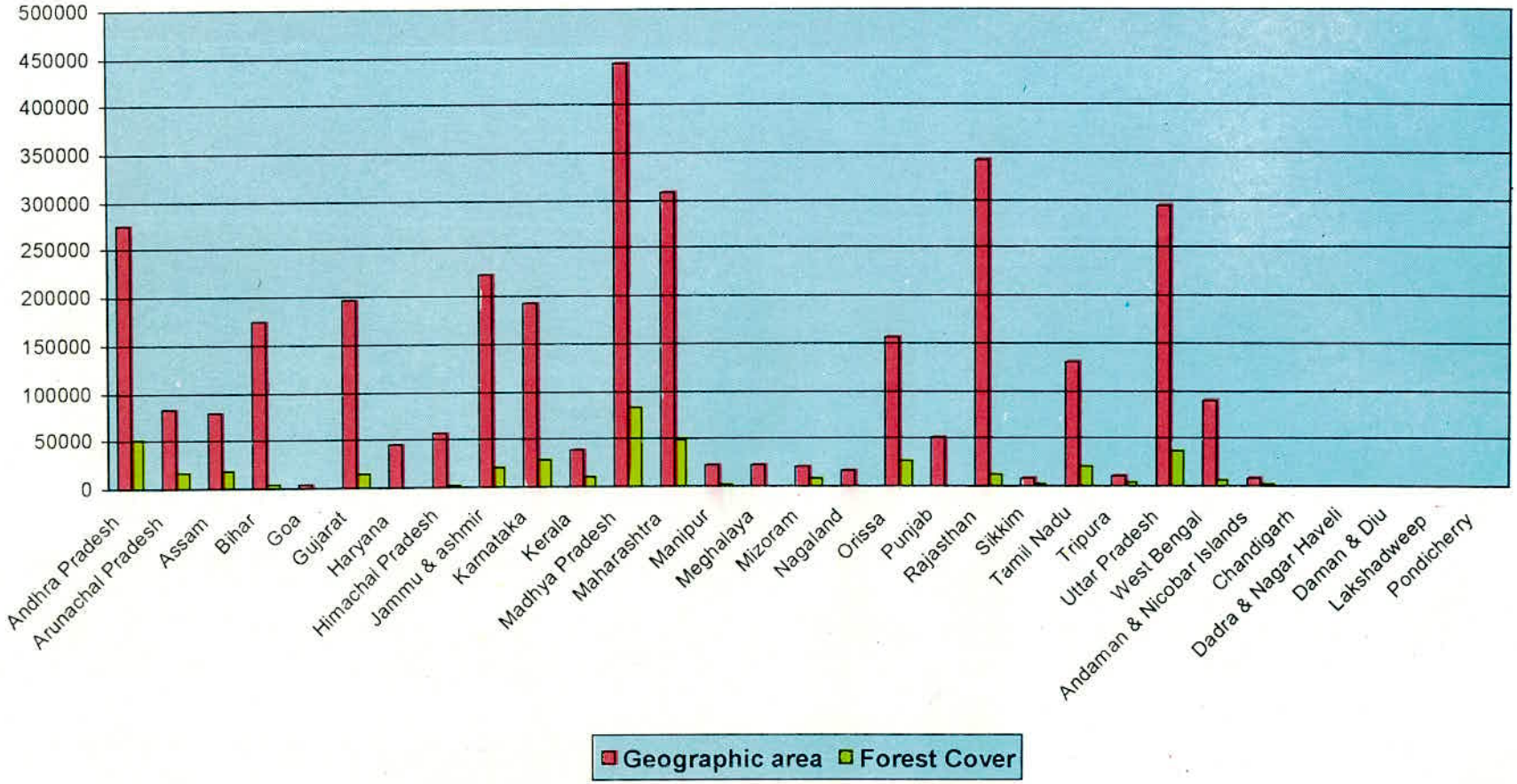

TABLE 3.2.2 : FOREST COVER AS PER 1999 ASSESSMENT

Lnad Use	Area in Sq. Km.	Percentage
Dense Forest	377358	11.48
Open Forest	255064	7.76
Mangrove	4871	0.15
Sub-Total	**637293**	**19.39**
Scrub	51896	1.58
Non-Forest	2598074	79.03
Total	**3287263**	**100.00**

Source : State of Forest Report, 1999

TABLE 3.2.3 : FOREST COVER CHANGE MATRIX

(Area in Sq. Km)

1997 Assessment	1999 Assessment					
	Dense Forest	Open Forest	Mangrove	Scrub	Non-Forest	Total 1997
Dense Forest	363861	2273	—	8	618	367260
Open Forest	10860	250306	—	—	144	261310
Mangrove	—	—	4811	—	16	4827
Scrub	1516	653	—	51000	4042	57211
Non-Forest	1121	1332	60	888	2593254	2596655
Total 1999	**377358**	**255064**	**4871**	**51896**	**2598074**	**3287263**
Net Change	**10098**	**-6246**	**44**	**-5315**	**1419**	

Source : State of Forest Report, 1999

The change matrix, given above, reveals that there, has been an overall increase of 10,098 Sq. Km. of dense forest during the period 1997-99. This is the result of improvement of 10,860 Sq. km. Of open forest, 1,516 sq. km. of non-forest. This is partly offset by a degradation of 2.773 sq. km. of dense forest to open forest, 8 sq. km. to scrub and 618 sq. km. to non-forest.

TABLE 3.2.4(a) : STATE-WISE AREA UNDER FOREST BY OWNERSHIP (AS ON 31-3-96)

(Sq. Km.)

State/ Union Territory	Forest Department					Others		
Forests	Reserve Forests	Protected Forests	Unclassed	Total Under Sanctioned Working plans	Area Depart-ment Forest	Revenue Bodies Forest/ Community Ownership	Corporate Forest	Private
Andhra Pradesh	50479.0	12365.0	970.0	63814.0	—	—	—	—
Arunachal Pradesh	10156.7	9590.8	47723.5	67471.0	6285.5	2386.2	800.1	N.A.
Assam	17588.9	3933.6	9185.1	30707.6	N.A.	N.A.	N.A.	N.A.
Bihar	5051.0	25014.0	7.0	30072.0	30072.0	—	911.0	—
Delhi	77.8	2.2	4.3	84.3	N.A.	—	12.0	—
Goa	165.4	668.7	390.3	1224.4	1224.4	—	—	200.0
Gujarat	—	—	—	—	—	—	—	—
Haryana	247.0	1149.0	19.0	1415.0	755.0	—	—	82.0
Himachal Pradesh	1396.0	31541.0	684.0	33621.0	25074.0	—	39.0	1358.0
Jammu & Kashmir	20230.0	—	—	20230.0	20194.0	—	—	—
Karnataka	28380.6	1833.8	3967.2	34181.6	25913.9	3794.3	——	308.4
Kerala	9344.0	1893.1	—	11237.1	2933.6	6.5	—	72.4
Madhya Pradesh	82700.1	66693.8	5112.5	154506.4	154506.4	499.4	—	—
Maharashtra	44160.0	9073.0	2354.0	55587.0	50028.0	5248.0	2977.0	523.0
Manipur	1467.0	4171.0	11983.0	17621.0	1467.0	N.A.	N.A.	N.A.
Meghalaya	980.6	12.4	—	993.0	294.4	—	—	—
Mizoram	4406.0	1044.2	N.A.	5450.2	N.A.	10477.9	2562.0	85.9
Nagaland	85.8	507.6	414.8	1008.2	N.A.	Nil	—	7621.1
Orissa	26331.2	29713.2	15.2	56059.6	30281.0	N.A.	N.A.	N.A.
Punjab	43.4	1108.0	217.6	1369.0	1240.8	—	517.7	1016.5
Rajasthan**	11521.5	17670.1	2780.8	31972.4	—	—	—	—
Sikkim	5645.9	42.7	510.7	6199.3	—	—	—	183.4
Tamil Nadu	19250.0	2192.0	1306.0	22748.0	19655.8	N.A.	N.A.	N.A.
Tripura	4097.0	Nil	2196.0	6293.0	4583.8	Nil	Nil	Nil
Uttar Pradesh	36628.0	1075.0	3272.0	40975.0	40758.0	7044.0	3567.0	62.0
West Bengal	7054.0	3772.0	1053.0	11879.0	11381.0	—	—	—
A&N Islands	2928.8	4241.9	—	7170.7	2099.0	—	—	—
D&N Haveli	198.8	4.8	—	203.6	198.8	—	—	—
Chandigarh	30.8	Nil	1.7	32.5	Nil	Nil	Nil	Nil
Lakshadweep	—	—	—	—	—	—	—	—
Pondicherry	—	—	—	—	—	—	—	—

Source : Forestry Statistics India, 1996

** : Figures as on 31-3-94

TABLE 3.2.4(b) : FOREST AREA BY COMPOSITION (AS ON 31-3-96)

(Sq. Km.)

State/ Union Territory	Coniferous forest			Broad Leaved Forest				Mixed	Total
	Chir	Deodar	Others	Sal	Teak	Mixed	Mangrove	Coniferous/ Broad leaved	
Andhra Pradesh	—	—	—	47	9145	54103	519	—	63814
Arunachal Pradesh	5398	Nil	—	0	5	31037	Nil	22940	59380
Assam	N.A.	N.A.	—	—	—	—	—	—	—
Bihar	—	—	—	16078	104	—	—	13890	30072
Delhi	—	—	—	—	—	96	—	—	96
Goa	—	—	—	—	—	—	2	—	2
Gujarat	—	—	—	—	—	—	—	—	0
Haryana	23	—	—	47	—	1345	—	—	1415
Himachal Pradesh	1460	645	6234	183	—	975	—	4590	14087
Jammu & Kashmir	1025	1075	5369	—	—	1885	—	10076	19430
Karnataka	—	—	—	—	—	—	—	—	—
Kerala	—	—	9	—	763	458	—	357	1587
Madhya Pradesh	—	—	—	25784	27783	100939	—	—	154506
Maharashtra	—	—	—	—	11160	38755	113	—	50028
Manipur	—	—	2442	—	610	9444	—	5125	17621
Meghalaya	—	—	145	—	—	733	—	—	878
Mizoram	—	—	324	—	476	19500	—	—	20300
Nagaland	Nil	Nil	278	Nil	Nil	2269	Nil	Nil	2547
Orissa	N.A.	N.A.	4	16938	2031	21024	195	N.A.	40192
Punjab	122	—	—	—	—	2755	—	27	2904
Rajasthan	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Sikkim	—	—	950	25	1	1092	—	—	2068
Tamil Nadu	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Tripura	Nil	Nil	Nil	239	550	2944	Nil	Nil	3733
Uttar Pradesh	4122	247	1197	4372	696	12293	—	18048	40975
West Bengal	—	—	89	—	—	—	2189	9681	11959
A&N Islands	—	—	—	—	—	6393	778	—	7171
D&N Haveli	—	—	—	—	—	204	—	—	204
Chandigarh	Nil	Nil	Nil	Nil	Nil	Nil	Nil	32	32
Lakshadweep	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Pondicherry	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A	N.A.	N.A.

Source : Forestry Statistics India, 1996

810 SPI/2001—6A

TABLE 3.2.5 : CUMULATIVE AREA OF FOREST PLANTATIONS BY ALL AGENCIES IN THE STATES/UT'S FROM 1951 TO 1999

(000 ha)

State/UT's	Total Cumulative plantation	Area of Block plantation	Area covered from seedlings distributed
Andhra Pradesh	2496.56	1260.3	1236.26
Arunachal Pradesh	160.95	155.73	5.22
Assam	451.78	433.58	18.2
Bihar	1326.23	942.12	384.11
Delhi	44.05	20.18	23.87
Goa	65.6	46.04	19.56
Gujarat	2981.08	1293.95	1687.13
Haryana	742.74	597.02	145.72
Himachal Pradesh	719.44	665.84	53.6
Jammu & Kashmir	382.43	323.04	59.39
Karnataka	2163.22	1573.19	590.03
Kerala	688.12	483.63	204.49
Madhya Pradesh	3364.13	2848.52	515.61
Maharashtra	2965.07	2130.39	834.68
Manipur	154.76	139.69	15.07
Meghalaya	164.48	130.67	33.81
Mizoram	308.55	255.73	52.82
Nagaland	174.2	116.43	57.77
Orissa	1827.41	1458.49	368.92
Punjab	512.38	417.6	94.78
Rajasthan	1410.1	1150.79	259.31
Sikkim	119.23	107.53	11.7
Tamil Nadu	2268.18	1616.18	652.0
Tripura	246.64	215.61	31.03
Uttar Pradesh	4185.77	1844.36	2341.41
West Bengal	1157.73	610.93	546.8
Andaman & Nicobar Islands	88.14	83.13	5.01
Chandigarh	10.07	9.85	0.22
Dadra & Nagar Haveli	18.36	11.01	7.35
Daman & Diu	1.39	0.85	0.54
Lakshadweep	2.5	0.57	1.93
Pondicherry	7.88	1.91	5.97
Total	**31209.17**	**20944.86**	**10264.31***

Source: State of Forest Report, 1999

* : The area has been estimated by FSI using 1990-1999 figures of NAEB where breakup of block plantation and seedlings distributed are available.

810 SPI/2001—6B

TABLE 3.2.6(a) : COMPARATIVE SITUATION OF FOREST COVER IN INDIA

(Sq. Km.)

S.No.	State/UTs	1999 Assessment	1997 Assessment	1995 Assessment	Changes in 1999	Changes in 1997
1.	Andhra Pradesh	44229	43290	47112	939	-3822
2.	Arunachal Pradesh	68847	68602	68621	245	-19
3.	Assam	23688	23824	24061	-136	-237
4.	Bihar	26474	26524	26561	-50	-37
5.	Delhi	88	26	26	62	0
6.	Goa*	1251	1252	1250	-1	2
7.	Gujarat	12965	12578	12320	387	258
8.	Haryana	964	604	603	360	1
9.	Himachal Pradesh	13082	12521	12501	561	20
10.	Jammu & Kashmir	20441	20440	20433	1	7
11.	Karnataka	32467	32403	32382	64	21
12.	Kerala	10323	10334	10336	-11	-2
13.	Madhya Pradesh	131830	131195	135164	635	-3969
14.	Maharashtra	46672	46143	43843	529	2300
15.	Manipur	17384	17418	17558	-34	-140
16.	Meghalaya	15633	15657	15714	-24	-57
17.	Mizoram	18338	18775	18576	-437	199
18.	Nagaland	14164	14221	14291	-57	-70
19.	Orissa	47033	46941	47107	92	-166
20.	Punjab	1412	1387	1342	25	45
21.	Rajasthan	13871	13353	13280	518	73
22.	Sikkim	3118	3129	3127	-11	2
23.	Tamil Nadu	17078	17064	17045	14	19
24.	Tripura	5745	5546	5538	199	8
25.	Uttar Pradesh	34016	33994	33986	22	8
26.	West Bengal	8362	8349	8276	13	73
27.	Andaman & Nicobar Islands	7606	7613	7615	-7	-2
28.	Chandigarh	7	7	7	0	0
29.	Dadra & Nagar Haveli	202	204	204	-2	0
30.	Daman & Diu	3	3	NA	0	
31.	Lakshadweep	0	0	NA	0	
32.	Pondicherry	0	0	NA	0	
	Total	637293	633397	638879	3896	-5482

Source: Forest Survey of India, The State of Forest Report 1999.
* : For the year 1995, the figure relates to Goa, Daman & Diu

In the year 1997, as compared to 1995, the total forest cover had decreased by 5482 Sq. Kms. The states which have shown significant decrease in the forest covers are Andhra Pradesh, 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. However, it has increase in 1999 by 3896 Sq. Kms. as compared to 1997.

TABLE 3.2.6 (b) : CHANGE IN FOREST COVER OF

State

TABLE 3.2.8 : STATE-WISE PRODUCTION OF FOREST PRODUCE

State/Union Territory	Timber (Cu.metre)	Poles (No.)	Fuelwood (Tonne)	Bamboo (No.)	Resin (Tonne)	Gums (Tonne)	Canes (Tonne)	Other NTFP
1995-96								
States:								
Andhra Pradesh	22339	282290	73370	83732b	-	639	..	12029
Arunachal Pradesh	..	..	..	..	..	..	..	..
Assam	..	..	..	..	..	..	..	..
Bihar	147229	1839586a	53981	8125b	..	..	-	6236
Goa	194	427	2369a	10000	-	..	74000	–
Gujarat	36600	..	17100	12636b	..	126	12	2420
Haryana	53006	..	74981a	1423590	..	..	..	9230
Himachal Pradesh	425784	..	10553	..	87833	-	-	..
Jammu & Kashmir	112880	..	5450a	..	8708	-	-	349
Karnataka	60192	830065a	310474	59504b	..	36	-	8941
Kerala	61430	361179	45336	1339741	-	..	441980c	..
Madhya Pradesh	517000	..	516000a	..	..	..	-	..
Maharashtra	85534	..	303042a	245910b	..	134	..	1333
Manipur	22366	30a	53804a	900865	..	..	..	147560f
Meghalaya	461748	..	..	..	16	..	423850d	..
Mizoram	128400	7169	12277	1277525	..	..	..	..
Nagaland	62467	49843a	98838a	..	..	..	61411d	–
Orissa	..	..	..	217802b	-	-	..	5803776
Punjab	79144	..	2331	151357	-	-	-	17071
Rajasthan	1000b	..	10000	2078000	..	938	269856c	..
Sikkim	..	..	..	..	..	..	..	-
Tamil Nadu	5385	5050	354209	1154b	146	..	-	..
Tripura	1506	..	5089a	696b	-	-	..	..
Uttar Pradesh	403203	..	207410	185851	..	..	..	-
West Bengal	8855	$	297143a	10550	72539	1163	..	327089
A & N Islands	97279	-	48585	2068352	-	-	-	60
							4015e	408
							853149d	72320

Source: Forestry Statistics India 1996.

a Figures in cu.metre. b Figures in Tonne. c Figures in Nos

d Canes in running metre e Canes in bundles

f Sand, Stone and Earth in cubic metre and broom for 1994-95 in bundles.

g Posts, Ballies, Thatching Leaves and Pharies are in Numbers & others in cu.metre.

h Firewood, Sand in cu.metre and Sungrass in bundles.

$ Prouduction of poles included in Fuelwood.

Note : Data in respect of Union Territories except A & N Islands is nil/negligible.

TABLE 3.2.8 :STATE-WISE PRODUCTION OF FOREST PRODUCE—Concld.

State/Union Territory	Pulp & Matchwood (cum)	Sal Seed (Tonne)	Tendu/Kendu/Biddi leaves (Tonne)
1995-96			
States :			
Andhra Pradesh	..	..	34936
Arunachal Pradesh	..	..	..
Assam	..	..	..
Bihar	..	4775$	575000$
Goa	..	..	..
Gujarat	..	..	213792$
Haryana	35856	-	..
Himachal Pradesh	..	..	-
Jammu & Kashmir	..	..	-
Karnataka	526565	..	1379
Kerala	..	..	..
Madhya Pradesh	..	..	3956444$
Maharashtra	..	..	797729$
Manipur	..	..	..
Meghalaya	..	..	..
Mizoram	-	-	-
Nagaland	-	-	-
Orissa	..	21073	38600
Punjab	..	..	..
Rajasthan	..	-	4
Sikkim	..	..	-
Tamil Nadu	106394	..	-
Tripura	-	-	..
Uttar Pradesh	..	911$	195885$
West Bengal	..	865	1455
U.T.			
A & N Island	29300	-	-

Source: Forestry Statistics India 1996.
$: Production of Tendu leaves in standard bags.

TABLE 3.2.9 : 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 3.2.10 : ESTIMATES OF WASTELANDS IN INDIA.

('000 Sq. Km.)

States/Uts.	Non Forest Degraded Area	Forest Degraded Area	Total
Andhra Pradesh	76.82	37.34	114.16
Assam	9.35	7.95	17.30
Bihar	38.96	15.62	54.58
Gujarat	71.53	6.83	78.36
Haryana	24.04	0.74	24.78
Himachal Pradesh	14.24	5.34	19.58
Jammu & Kashmir	5.31	10.34	15.65
Karnataka	71.22	20.43	91.65
Kerala	10.53	2.26	12.79
Madhya Pradesh	129.47	71.95	201.42
Maharashtra	115.6	28.41	144.01
Manipur	0.14	14.24	14.38
Meghalaya	8.15	11.03	19.18
Nagaland	5.08	8.78	13.86
Orissa	31.57	32.27	63.84
Punjab	11.51	0.79	12.30
Rajasthan	180.01	19.33	199.34
Sikkim	1.31	1.5	2.81
Tamilnadu	33.92	10.09	44.01
Tripura	1.08	8.65	9.73
Uttar Pradesh	66.35	14.26	80.61
West Bengal	21.77	3.59	25.36
Uts	8.89	27.15	36.04
Total	936.85	358.89	1295.74

Source : Forestry Statistics India,1996.

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TABLE 3.2.11: ESTIMATES OF NON-FOREST WASTELANDS IN INDIA

('000 Sq. Km)

States/UTs.	Saline & Alkaline Lands	Wind Eroded Area	Water Eroded Area	Total
Andhra Pradesh	2.40	....	74.42	76.82
Assam	....	....	9.35	9.35
Bihar	0.04	....	38.92	38.96
Gujarat	12.14	7.04	52.35	71.53
Haryana	5.26	15.99	2.76	24.01
Himachal Pradesh	....	....	14.24	14.24
Jammu & Kashmir	....	....	5.31	5.31
Karnataka	4.04	....	67.18	71.22
Kerala	0.16	....	10.37	10.53
Madhya Pradesh	2.42	....	127.05	129.47
Maharashtra	5.34	....	110.26	115.6
Manipur	....	....	0.14	0.14
Meghalaya	....	....	8.15	8.15
Nagaland	....	....	5.08	5.08
Orissa	4.04	....	27.53	31.57
Punjab	6.88	....	4.63	11.51
Rajasthan	7.28	106.23	66.59	180.1
Sikkim	....	....	1.31	1.31
Tamilnadu	0.04	....	33.88	33.92
Tripura	....	....	1.08	1.08
Uttar Pradesh	12.95	....	53.4	66.35
West Bengal	8.5	....	13.27	21.77
Uts	0.16	....	8.73	8.89
Total	71.65	129.26	736	936.91

Source : Forestry Statistics India, 1996.

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CHART 3 : FOREST AND NON-FOREST DEGRADED AREA

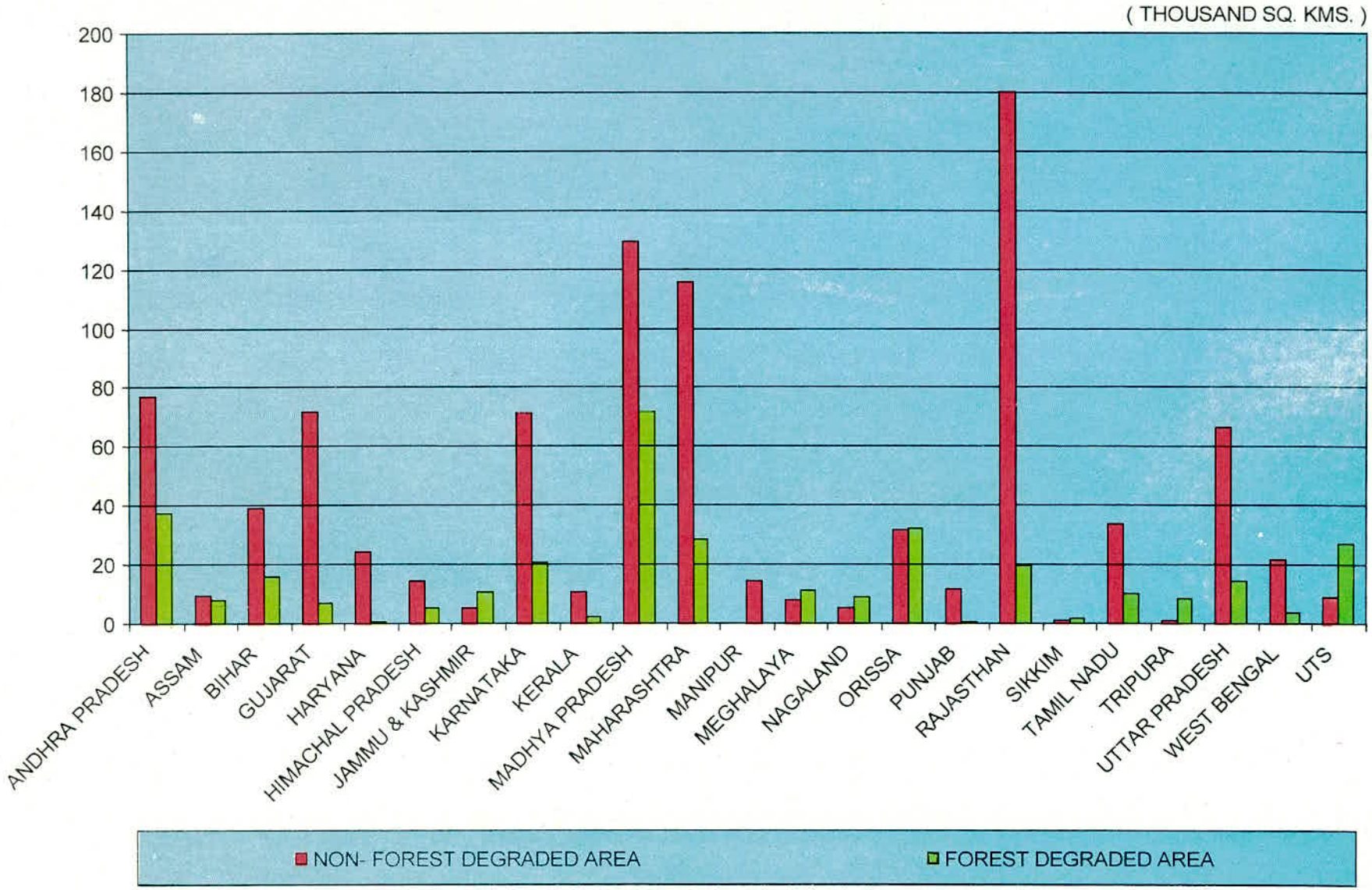

TABLE 3.2.12 : DIVERSION OF FOREST LAND FOR NON FOREST USE SINCE THE ENFORCEMENT OF FOREST CONSERVATION ACT,1980

(Sq. Km)

Year	Forest land Diversion
1980	Nil
1981	26.72
1982	32.47
1983	57.02
1984	78.38
1985	106.08
1986	119.63
1987	727.80
1988	187.65
1989	203.65
1990	1385.51*
1991	6.25
1992	56.87
1993	117.86
1994	135.28
1995	461.59
1996	87.65

Source : Forestry Statistics India, 1996.

* Includes :

I. 1830 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

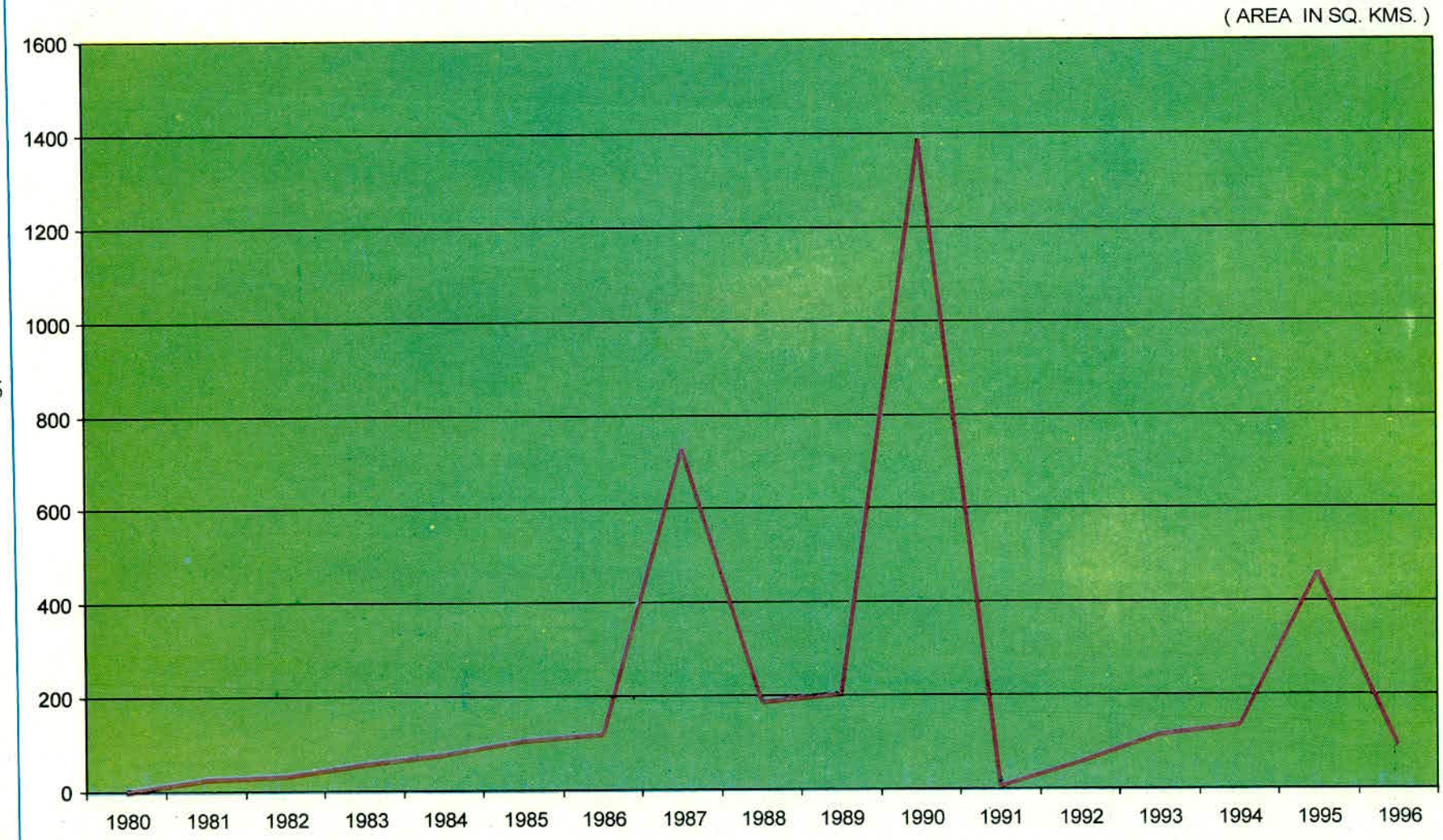

TABLE 3.2.13 : STATEWISE SHOWING THE PHYSICAL AND FINANCIAL ACHIEVEMENTS OF THE ONGOING EXTERNALLY AIDED FORESTRY PROJECTS

S.No.	Name of Project/ Name State/Ut.	Aid Agency	Project period	Project Cost (Rs. in Cr.) as per APD	Physical Target (in 000 Ha)	Aid Currency	Total Aid Component (in million) Foreign Exchange
1.	Forestry Sector Project, Maharashtra	World Bank	1992-93 to 1997-98	431.51	369.00	US $	108.00
2.	Forestry Project, Andhra Pradesh	World Bank	1994-95 to 1999-2000	353.92	355.00	US $	77.40
3.	Forestry Project, Madhya Pradesh	World Bank	1995-96 to 1998-99	245.94	235.00	US $	58.00
4.	Forestry Project, Uttar Pradesh	World Bank	1997-98 to 2000-2001	272.00	160.00	US $	52.00
5.	Kerala Forestry Project	World Bank	1998-99 to 2001-2002	183.00	54.60	US $	39.00
6.	IGNP, Rajasthan	OECF (Japan)	1990-91 to 1999-2000	107.50	61.50	YEN	7869.00
7.	Afforestation of Aravalli Hills, Rajasthan	OECF (Japan)	1992-93 to 1998-99	176.69	115.00	YEN	8095.00
8.	Forestry Development Project, Rajasthan	OECF (Japan)	1995-96 to 1999-2000	139.18	55.00	YEN	4219.00
9.	Integrated Forestry Development Project, Gujarat	OECF (Japan)	1995-96 to 2000-2001	608.50	230.00	YEN	15760.00
10.	Tamilnadu Afforestation Project	OECF (Japan)	1996-97 to 2001-2002	499.20	405.00	YEN	13324.00
11.	Eastern Karnataka Afforestation Project	OECF (Japan)	1996-97 to 2001-2002	565.54	171.00	YEN	15968.00
12.	Punjab Afforestation Project	OECF (Japan)	1997-98 to 2004-2005	442.00	59.00	YEN	6193.00
13.	Western Ghats Forestry Projects, karnataka	DFID (U.K.)	1992-93 to 1997-98	84.20	61.00	U.K. Pound	18.07
14.	Himachal Pradesh Forestry Projects	DFID (U.K.)	1994-95 to 1999-2000	13.92	7.00	U.K. Pound	3.09
15.	Dungarpur Integrated Wasteland Development Project, Rajasthan	SIDA	1992-93 to 1997-98	28.21	47.00	SEK	80.00
16.	Capacity Building Project, Orrissa	SIDA	1997-98 to 1998-99	8.50	19.00	SEK	13.50
17.	Forestry and Eco-Development Project	FRG	1993-94 to 1998-99	18.70	11.00	German Mark	6.00
18.	Aravalli Hills Afforestation, Haryana	EEC	1990-91 to 1997-98	48.15	33.00	ECU	23.20
19.	West Bengal Forestry Projects	World Bank	1992-93 to 1997-98	114.00	206.00	US $	34 M
	Total			4340.66	2654.10		

Source : Forestry Statistics India, 1996.

TABLE 3.2.14 : AREA UNDER JOINT FOREST MANAGEMENT

Sr. No.	State/Uts	Date of Notification	No. of JFM Committees	Area under JFM ('000ha)
1	Andhra Pradesh	28.09.92	6575	1632.19
2	Arunachal Pradesh	03.10.97	10	5.29
3	Assam	10.11.98	101	3.06
4	Bihar	08.11.90	1675	935.08
6	Gujarat	13.03.91	706	91.07
7	Himachal Pradesh	12.05.93	203	62
8	Haryana	13.06.90	350	60.73
9	Jammu & Kashmir	19.03.92	1599	79.27
10	Karnataka	12.04.93	1212	12.8
11	Kerala	16.01.98	21	4
12	Madhya Pradesh	10.12.91	12038	5800
13	Maharashtra	16.03.92	502	94.73
14	Mizoram	18.09.98	103	5.87
15	Nagaland	05.03.97	55	0.65
16	Orissa	3.08.88	3704	419.31
17	Punjab	14.07.93	89	38.99
18	Rajasthan	16.03.91	2705	235.63
19	Sikkim	26.06.98	98	2.19
20	Tamil Nadu	8.08.97	599	224.38
21	Tripura	20.12.91	157	16.23
22	Uttar Pradesh	30.08.97	197	34.59
23	West Bengal	12.07.89	3431	490.58
	Total		36130	10248.64

Source : State of Forest Report, 1999

Participation of people in the protection and management of forests has been emphasised in the National Forest Policy, 1988. Pursuant to this policy, Government of India' through its resolution dated 1st June'90 formalised the JFM Programme. The JFM is being practiced through constitution of forest protection committees. The mechanism of sharing usufructs differs from state to state. About 36,130 committees are managing a total of 10.25 million ha of forest area under JFM . Details of number of committees and area under their management is given in the table above.

TABLE 3.2.15 : FOREST COVER IN MINING AREAS BY STATE

State	Lease area(ha)	Forest Cover (ha)		
		Dense	Open	Total
Bihar	21,589	7,564	2,587	10,151
Orissa	37,664	9,764	9,499	19,263
Madhya Pradesh	31,442	20,388	3,415	23,803
Total	90,695	37,716	15,501	53,217

Source : State of Forest Reports, 1999

The Forest Survey of India in collaboration with the Indian Bureau of Mines, Nagpur, undertook a study in 1998 relating to assessment of forest cover in areas leased for mining of five important metallic minerals (Bauxite, Copper, Iron, Chromite, and Manganese) in three mineral rich states namely Bihar, M.P, Orissa. The forest cover maps on 1:50,000 scale were overlaid on the composite mineral maps. It has been found out that out of 90,695 ha of leased area, 53,217 is under forest cover of which 71% is under dense forest and 29% is under open forest.

Panthera Leo Male & Female

Rungdil, Mezoram

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(cold)	NA
4	Semi-Arid	Central India	107600
		Gujarat-Rajwara	400400
5	Western Ghats	Malabar Coast	59700
		Western Ghat Mountains	99300
6	Deccan Peninsula	Deccan South Plateau	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 (modified) and Zoological Survey of India

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TABLE 3.3.2 : ESTIMATED NUMBER OF SPECIES

Group	India	World	% in India
PROTISTA			
Protozoa	2577	31250	8.25
Subtotal	2577	31250	8.25
ANIMALIA			
Mesozoa	10	71	14.08
Porifera	486	4562	10.65
Cnidaria	842	9916	8.49
Ctenoeehora	12	100	12.00
Platyhelminthes	1622	17500	9.27
Nemertinea	—	600	—
Rotifera	330	2500	13.20
Gastrotricha	100	3000	3.33
Kinorhyncha	10	100	10.00
Nematoda	2850	30000	9.50
Nematomorpha	—	250	—
Acanthocephala	229	800	28.63
Sipuncula	35	145	24.14
Mollusea	5070	66535	7.62
Echiura	43	127	33.86
Annelida	840	12700	6.61
Onychophora	1	100	1.00
Arthopoda	**68389**	**987949**	6.92
Crustacea	2934	35534	8.26
Insecta	59353	867391	6.84
Arachnida	5818	73440	7.92
Pycnogonida	16	600	2.67
Pauropoda	—	360	—
Chilopoda	100	3000	3.33
Diplopoda	162	7500	2.16
Symphyla	4	120	3.33
Merostomata	2	4	50.00
Phoronida	3	11	27.27
Bryozoa (Ecpoprocta)	200	4000	5.00
Entoprocta	10	60	16.67
Brachiopoda	3	300	1.00
Pogonophora	—	80	—
Priapulida	—	8	—
Pentastomida	—	70	—
Chaetognatha	30	111	27.03
Tardigrada	30	514	5.84
Echinodurmata	765	6223	12.29
Hemichordata	12	120	10.00

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TABLE 3.3.2 : ESTIMATED NUMBER OF SPECIES—*Concld.*

Group	India	World	% in India
Chordata	**4886***	**48451**	**10.07**
Protochordata (Cephalochordata +Urochordata)	119	2106	5.65
Pisces	2546	21723	11.72
Amphibia	209	5150	4.06
Reptilia	456	5817	7.84
Aves	1166*	9026	12.91
Mammalia	390	4629	8.43
Total (Animalia)	**86808***	**1196903**	**7.25**
Grand Total (Protista + Animalia)	**89385***	**1228153**	**7.28**

Source : Faunal Diversity in India (1998) with updated (*) figures
Zoological Survey of India

TABLE 3.3.3 : RARE AND THREATENED SPECIES (VERTEBRATES)

Category	Approximate Number				
	Mammalia	Aves	Reptilia	Amphibia	Total
Rare	——	2	——	——	2
Vulnerable	28	22	4	——	54
Endangered	29	21	16	1	67
Critical*	3	8	——	——	11
Extinct**	1	2	——	——	3
Insufficiently Known	16	——	——	——	16
Total	**77**	**55**	**20**	**1**	**153**

Source : The Red Data Book of Indian Animals (1994)
Zoological Survey of India

* **Mammal-** Brow - Altered Deer, Yak, Hispid Hare

Aves - Christmas Island Frigate Bird, Mrs. Hume's Bartailed Pheasant, Burmese Peafowl, Blacknecked Crane, Hooded Crane, Masked Finfoot, Jerson's Courser, Forest Spotted Owlet.

** **Mammal-** Cheetah.

Aves - Pinkheaded Duck, Mountain Quail

TABLE 3.3.4 : ENDEMIC AND THREATENED SPECIES

Faunal Groups	Total No.	Endemic Species		Threatened
		Number	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 : ZSI, ENVIS Newsletter, 4(182), 1997
*Source : Red Data Book, ZSI, 1994

TABLE 3.3.5 : NATIONAL PARKS AND WILDLIFE SANCTUARIES OF INDIA

(Sq. Km.)

S.No.	State	National Parks		Wildlife Sanctuaries		Total Area
		Number	Area	Number	Area	
1	Andhra Pradesh	4	3314.50	21	12530.09	15844.59
2	Arunachal Pradesh	2	2468.23	10	7114.45	9582.68
3	Assam	3	1173.71	13	939.88	2113.59
4	Bihar	2	567.32	21	3890.25	4457.57
5	Delhi	0	0.00	1	27.60	27.60
6	Goa	1	107.00	6	647.96	754.96
7	Gujarat	4	479.67	21	16422.71	16902.38
8	Haryana	1	1.43	9	278.32	279.75
9	Himachal Pradesh	2	1429.40	32	5736.85	7166.25
10	Jammu & Kashmir	4	4650.07	16	10172.15	14822.22
11	Karnataka	5	2472.18	20	3930.61	6402.79
12	Kerala	3	536.52	12	2143.36	2679.88
13	Madhya Pradesh	11	6474.69	35	10704.05	17178.74
14	Maharashtra	5	955.93	33	14387.78	15343.71
15	Manipur	2	81.80	1	184.85	266.65
16	Meghalaya	2	267.48	3	34.20	301.68
17	Mizoram	2	250.00	4	634.00	884.00
18	Nagaland	1	202.02	3	24.41	226.43
19	Orissa	2	990.70	18	6971.15	7961.85
20	Punjab	0	0	11	317.79	317.79
21	Rajasthan	4	3856.53	24	5712.83	9569.36
22	Sikkim	1	1784.00	5	265.10	2049.10
23	Tamil Nadu	5	307.85	20	2602.07	2909.92
24	Tripura	0	0	4	603.62	603.62
25	Uttar Pradesh	7	5410.82	29	7594.54	13005.36
26	West Bengal	5	1692.65	16	1103.48	2796.13
27	Andaman & Nicobar Islands	9	1157.14	94	372.13	1529.27
28	Chandigarh	0	0	2	26.01	26.01
29	Dadra & Nagar Haveli	0	0	0	0	0.00
30	Daman & Diu	0	0	1	2.18	2.18
31	Lakshadweep	0	0	0	0	0.00
32	Pondicherry	0	0	0	0	0.00
	Total	**87**	**40631.64**	**485**	**115374.42**	**156006.06**

Source: State of Forest Report, 1999

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 485 Wildlife Sanctuaries and 87 National Parks, covering an area of 156006 Sq. Km.

TABLE 3.3.6 : ALL INDIA TIGER POPULATION

S. No.	Name of State	Years					
		1972	1979	1984	1989	1993	1997
1	Andhra Pradesh	35	148	164	235	197	171
2	Arunachal Pradesh	69	139	219	135	180	N.R.
3	Assam	147	300	376	376	325	458
4	Bihar	85	110	138	157	137	103
5	Goa Daman & Diu	—	—	—	2	3	6
6	Gujarat	8	7	9	9	5	1
7	Karnataka	102	156	202	257	305	350
8	Kerala	60	134	89	45	57	N.R.
9	Madhya Pradesh	457	529	786	985	912	927
10	Maharashtra	160	174	301	417	276	257
11	Manipur	1	10	6	31	—	N.R.
12	Meghalaya	32	35	125	34	53	N.R.
13	Mizoram	—	65	33	18	28	12
14	Nagaland	80	102	104	104	83	N.R.
15	Orissa	142	173	202	243	226	194
16	Rajasthan	74	79	96	99	64	58
17	Sikkim	—	—	2	4	2	N.R.
18	Tamil Nadu	33	65	97	95	97	62
19	Uttar Pradesh	262	487	698	735	465	475
20	West Bengal	73	296	352	353	335	361
21	Haryana	—	—	1	—	—	N.R.
22	Tripura	7	6	5	—	—	N.R.
	Total	1827	3015	4005	4334	3750	3435

Source : Project Tiger, Ministry of Environment & Forests.

N.R. : Not Reported.

TABLE 3.3.7 : LIST OF PROJECT TIGER AREAS IN INDIA

Sl. No.	Year of Creation	Name of Tiger Reserves	State	Total Area in Sq. Kms.
1	1973-74	Bandipur	Karnataka	866
2	1973-74	Corbett	Uttar Pradesh	1316
3	1973-74	Kanha	Madhya Pradesh	2840
4	1973-74	Manas	Assam	2840
5	1973-74	Melghat	Maharashtra	1677
6	1973-74	Palamau	Bihar	1026
7	1973-74	Ranthambhore	Rajasthan	1334
8	1973-74	Similipal	Orissa	2750
9	1973-74	Sunderbans	West Bengal	2585
10	1978-79	Periyar	Kerala	777
11	1978-79	Sariska	Rajasthan	866
12	1982-83	Buxa	West Bengal	759
13	1982-83	Indravati	Madhya Pradesh	2799
14	1982-83	Nagarjunsagar	Andhra Pradesh	3568
15	1982-83	Namdapha	Arunachal Pradesh	1985
16	1987-88	Dudhwa	Uttar Pradesh	811
17	1988-89	Kalakad- Mundathurai	Tamil Nadu	800
18	1989-90	Valmiki	Bihar	840
19	1992-93	Pench	Madhya Pradesh	758
20	1993-94	Tadoba-Andheri	Maharashtra	620
21	1993-94	Bandhavgarh	Madhya Pradesh	1162
22	1994-95	Panna	Madhya Pradesh	542
23	1994-95	Dampha	Mizoram	500
24	1998-99	Bhadra	Karnataka	492
25	1998-99	Pench	Maharashtra	257
	Total			33875

Source : Ministry of Environment and Forests, Annual Report, 1999-2000.

TABLE 3.3.8 : POPULATION OF TIGERS IN TIGER RESERVES

S. No.	Name of Tiger Reserves	State	Population of Tigers						
			1972	1979	1984	1989	1993	1995	1997
1	Bandhavgarh	Madhya Pradesh	—	—	—	—	41	46	46
2	Bandipur	Karnataka	10	39	53	50	66	74	75
3	Buxa	West Bengal	—	—	15	33	29	31	32
4	Corbett	Uttar Pradesh	44	84	90	91	123	128	138
5	Dampha	Mizoram	—	—	—	—	7	4	5
6	Dudhwa	Uttar Pradesh	—	—	—	90	94	98	104
7	Indravati	Madhya Pradesh	—	—	38	28	18	15	15
8	Kalakad	Tamilnadu	—	—	—	22	17	16	28
9	Kanha	Madhya Pradesh	43	71	109	97	100	97	114
10	Manas	Assam	31	69	123	92	81	94	125
11	Melghat	Maharashtra	27	63	80	77	72	71	73
12	Nagarjunsagar	Andhra Pradesh	—	—	65	94	44	34	39
13	Namdapha	Arunachal Pradesh	—	—	43	47	47	52	57
14	Palamau	Bihar	22	37	62	55	44	47	44
15	Panna	Madhya Pradesh	—	—	—	—	25	22	22
16	Pench	Madhya Pradesh	—	—	—	—	39	27	29
17	Periyar	Kerala	—	34	44	45	30	39	N.R.
18	Ranthambhore	Rajasthan	14	25	38	44	36	38	32
19	Sariska	Rajasthan	—	19	26	19	24	25	24
20	Simplipal	Orissa	17	65	71	93	95	97	98
21	Sunderbans	West Bengal	60	205	264	269	251	242	263
22	Tadoba	Maharashtra	—	—	—	—	34	36	42
23	Valmiki	Bihar	—	—	—	81	49	N.R.	53
	Total		268	711	1121	1327	1366	1333	1458

Source : Project Tiger, Ministry of Environment & Forests.

N.R. : Not Reported

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 1458 in 1997.

TABLE 3.3.9 : SEIZURE OF WILDLIFE ARTICLES

(Value in Rs.)

State/UT's	Name of the Article	1994-95		1995-96	
		Number	Value	Number	Value
Andhra Pradesh	1 Leopard Skin	1	N.A.	—	—
	2 Barking Deer Skin	1	N.A.	—	—
	3 Deerhorns	6.46 Qtl	N.A.	—	—
	4 Jacana	1	N.A.	—	—
	5 Horn	1	N.A.	—	—
	6 Tiger Skin	—	—	1	N.A.
	7 Panther Skin	—	—	1	N.A.
	8 Cheeta Skin	—	—	1	N.A.
Arunachal Pradesh	1 Animal Skin (Misc.)	32	N.A.	Nil	Nil
	2 Animal Teeth (Misc.)	35	N.A.	Nil	Nil
	3 Rhino Horn	1	N.A.	Nil	Nil
Assam	N.A.	N.A.	N.A.	N.A.	N.A.
Bihar	1 Tusk of elephant	6.5Kg.	—	—	—
	2 Leopard Skin	2	—	2	—
	3 Tiger Skin	1	—		—
	4 Deer	—	—	1	—
	5 Tiger	—	—	1	—
	6 Leopard	—	—	3	—
	7 Hyaena	—	—	1	—
Delhi	1 Live Animals	2	N.A.	6	N.A.
	2 Live Birds	6415	N.A.	8543	N.A.
	3 Dead Animals	6	N.A.	12	N.A.
	4 Mongoose hair	12.6 Kg	N.A.	1.2 Kg	N.A.
	5 Mongoose hair brush	3367	N.A.	12068	N.A.
	6 Tiger Skin	1	N.A.	—	N.A.
	7 Leopard Skin	13	N.A.	17	N.A.
	8 Leopard Bone	3.2 Kg	N.A.	—	N.A.
	9 Snake Skin (Articles)	59	N.A.	3	N.A.
	10 Other skins	1546	N.A.	1282	N.A.
Goa	1 Porcupine	1	N.A.	—	—
Gujarat	N.A.	N.A.	N.A.	N.A.	N.A.
Haryana	Nil	Nil	Nil	Nil	Nil
Himachal Pradesh	N.A.	N.A.	N.A.	N.A.	N.A.
Jammu & Kashmir	N.A.	N.A.	N.A.	N.A.	N.A.
Karnataka	N.A.	N.A.	N.A.	N.A.	N.A.
Kerala	N.A.	N.A.	N.A.	N.A.	N.A.
Madhya Pradesh	N.A.	N.A.	N.A.	N.A.	N.A.
Maharashtra	N.A.	N.A.	N.A.	N.A.	N.A.
Manipur	Birds (Schedule - IV)	8	N.A.	Nil	Nil

TABLE 3.3.9 : SEIZURE OF WILDLIFE ARTICLES—Contd.

(Value in Rs.)

State/UT's	Name of the Article	1994-95		1995-96	
		Number	Value	Number	Value
Meghalaya	1 Deer Skin	1	—	—	—
	2 Rhino Horn			1	—
	3 Wild Boar			1	—
	4 Civat Cat			2	—
	5 Deer Meat			1	—
	6 Clouded Leopard			1	—
	7 Butterfly Plaque			6	—
	8 Bison meat			1	—
Mizoram	Nil	Nil	Nil	Nil	Nil
Nagaland	Nil	Nil	Nil	Nil	Nil
Orissa	N.A.	N.A.	N.A.	N.A.	N.A.
Punjab	Nil	Nil	Nil	Nil	Nil
Rajasthan	N.A.	N.A.	N.A.	N.A.	N.A.
Sikkim	1 Pangolin	1	—	—	—
	2 Leopard Cat	—	—	1	—
	3 Flying Squirrel	—	—	1	—
	4 Common Squirrel	—	—	1	—
	5 Snake	—	—	1	—
Tamilnadu	1 Snake Skins	1210	N.A.	N.A.	N.A.
	2 Leopard Skin	3	N.A.	N.A.	N.A.
	3 Lady's purse made of leopard skins	3	N.A.	N.A.	N.A.
	4 Red fox skin	4	N.A.	N.A.	N.A.
	5 Red fox coat	2	N.A.	N.A.	N.A.
	6 Jungle cat coat	1	N.A.	N.A.	N.A.
	7 Samacha Skin	14	N.A.	N.A.	N.A.
	8 Mink Skin coat	2	N.A.	N.A.	N.A.
	9 Samacha Skin coat	1	N.A.	N.A.	N.A.
	10 Jungle Cat Skin cap	1	N.A.	N.A.	N.A.
	11 Deer Horn	—	—	2	—
	12 Ivory Tusks	—	—	8	—
Tripura	Elephant Tusks	4	N.A.	Nil	Nil
Uttar Pradesh	1 Leopard Skin	1	25000	1	N.A.
	2 Neelgai Skin	19	5000	—	—
	3 Deer Skin	1	1000	—	—
	4 Hyaena	2	2000	—	—
	5 Hyaena Skin	1	N.A.	1	N.A.
	6 Ghoral Skin	1	N.A.	1	N.A.
	7 Barking Deer Skin	1	N.A.	1	N.A.

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TABLE 3.3.9 : SEIZURE OF WILDLIFE ARTICLES—Concld.

(Value in Rs.)

State/UT's	Name of the Article	1994-95		1995-96	
		Number	Value	Number	Value
	8 Snow Leopard	1	N.A.	—	—
	9 Chital Skin	3	2000	2	N.A.
	10 Deer Horn	8	930	6	360
	11 Sambhar Horn	1	2000	—	—
	12 Chital Horn	2	2500	2	1640
	13 Lion Skin	—	—	4	N.A.
	14 Pythons Skin	1	1000	—	—
	15 Chital	1	N.A.	—	—
	16 Padda Skin	—	—	1	N.A.
West Bengal	1 Tiger Skin	6	—	7	—
	2 Tiger Claws	—	—	4	—
A & N Island	1 Deer Venision	26 Kg	700	—	—
	2 Deer (Live)	—	—	1	500
	3 Deer (Dead)	—	—	2	1000
	4 Andaman Green Impereal pigeon (Live)	1	60	29	1740
	5 Andaman Green Impereal pigeon (Dead)	—	—	7	420
	6 Live Flying bat	—	—	1	30
	7 Deer Horn	4	400	12	1200
	8 Deer Skin	1	100	15	1500
	9 Swiftlets nest	150 Gm	2000	7.35 Kgs.	95500
	10 Tortoise Shell	10 Kgs.	500	18 Kgs.	800
	11 Sea Cucamber	40 Kgs	6000	47 Kgs.	7000
	12 Venision	24 Kgs.	445	162 Kgs.	2684
	13 Sea Shell	36	200	—	—
D & N Haveli	Nil	Nil	Nil	Nil	Nil
Chandigarh	Nil	Nil	Nil	Nil	Nil
Lakshadweep	—	—	—	—	—
Pondicherry	—	—	—	—	—

Source : Forestry Statistics of India, 1996.

Equus Hemicnus Khur - Male

TABLE 3.3.10 : INDIA'S LIVESTOCK POPULATION

(In '000)

Livestock	Number of Animals			
	1977	1982	1987	1992
Cattle	180140	192453	199695	204584
Buffaloes	62019	69783	75966	84206
Sheep	40907	48765	45703	50783
Goats	75620	95255	110207	115279
Horses & Ponnies	916	900	797	817
Pigs	7647	10071	10625	12788
Mules	89	131	167	193
Donkeys	978	1024	958	967
Camels	1068	1078	1001	1031
Other Livestocks				
Yaks	132	128	36	58
Mithuns	129	154		
Total	369526	419588	445284	470860

Source : 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 5 : INDIA`S LIVESTOCK POPULATION

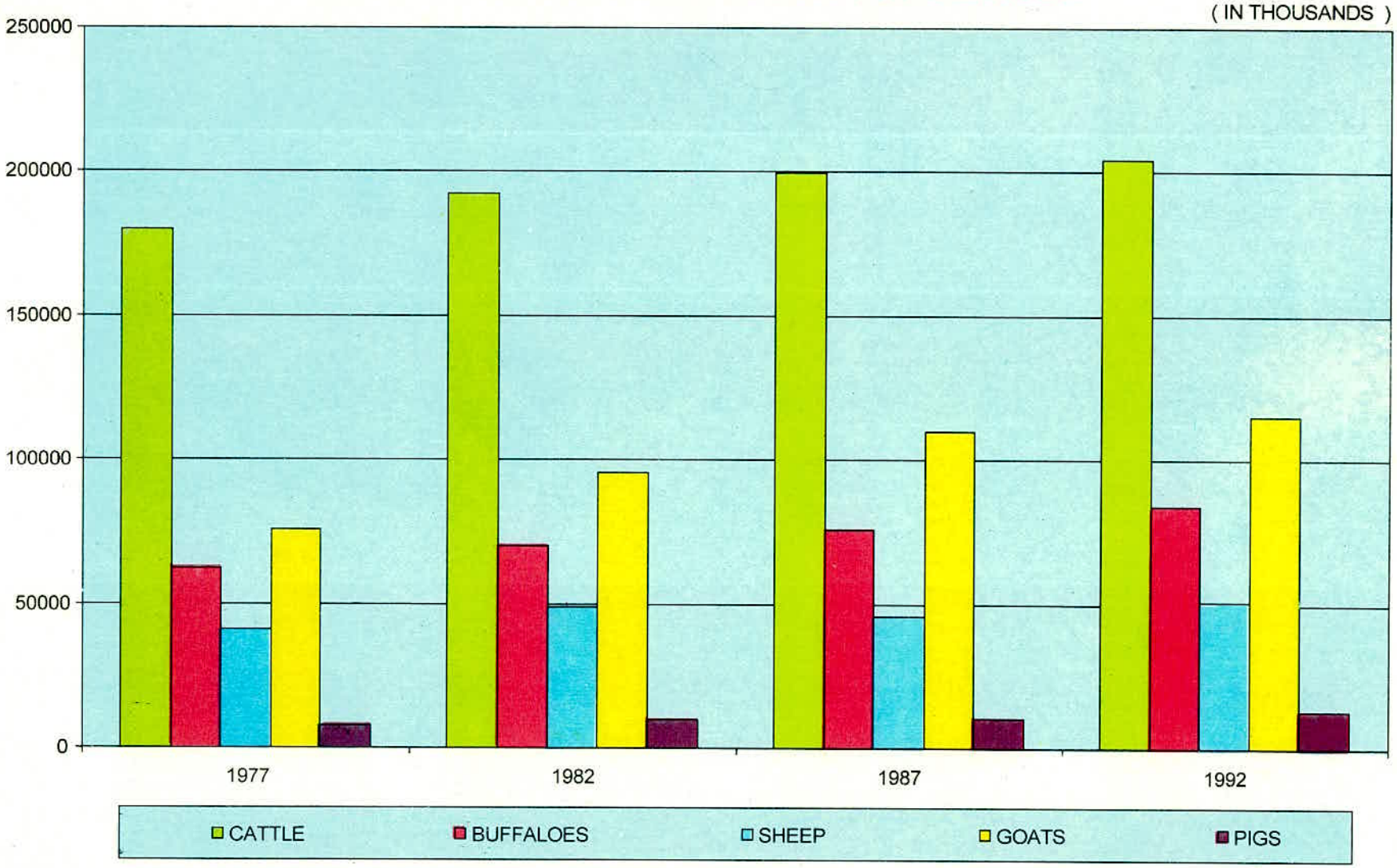

TABLE 3.3.11 : LIVESTOCK POPULATION AS PER 1992 CENSUS

(In '000)

Sr. 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 3.3.11 : LIVESTOCK POPULATION AS PER 1992 CENSUS—Contd.

(In '000)

Sr.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	Rajastnan	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 3.3.11 : LIVESTOCK POPULATION AS PER 1992 CENSUS —Contd.

(In '000)

Sr. No.	State/Uts	Goats	Horses and 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

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TABLE 3.3.11 : LIVESTOCK POPULATION AS PER 1992 CENSUS—Concld.

(In '000)

Sr. 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 & Dairy Development, Ministry of Agriculture.

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TABLE 3.3.12 : FISH PRODUCTION

(in Lakh tonne)

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	11.6	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
1997-98	29.50	24.38	53.88

Source : Department of Agriculture & Cooperation, Ministry of Agriculture

TABLE 3.3.13 : STATE-WISE FISH PRODUCTION, 1997-98 to 1998-99

(In Tonne)

States/UT's	1997-98			1998-99		
	Marine	Inland	Total	Marine	Inland	Total
Andhra Pradesh	146545	226314	372859	150000	260829	410829
Arunachal Pradesh	0	2130	2130	0	2301	2301
Assam	0	155132	155132	0	155714	155714
Bihar	0	208540	208540	0	202290	202290
Goa	88809	3240	92049	65841	3175	69016
Gujarat	745706	70798	816504	550000	80000	630000
Haryana	0	32050	32050	0	32520	32520
Himachal Pradesh	0	6685	6685	0	6786	6786
Jammu & Kashmir	0	18530	18530	0	18850	18850
Karnataka	189859	95275	285134	160612	95000	255612
Kerala	526342	57514	583856	583364	65855	649219
Madhya Pradesh	0	115161	115161	0	119592	119592
Maharashtra	453000	127000	580000	394883	125496	520379
Manipur	0	13700	13700	0	15309	15309
Meghalaya	0	3085	3085	0	4525	4525
Mizoram	0	2700	2700	0	2775	2775
Nagaland	0	3700	3700	0	4500	4500
Orissa	156081	153428	309509	124329	159904	284233
Punjab	0	36000	36000	0	44500	4450
Rajasthan	0	15100	15100	0	12000	120
Sikkim	0	140	140	0	140	1
Tamil Nadu	355100	109500	464600	359545	110200	4697
Tripura	0	27906	27906	0	28410	28
Uttar Pradesh	0	160017	160017	0	183030	1
West Bengal	164000	786020	950020	171500	823500	9
A & N Islands	27225	40	27265	27400	42	
Chandigarh	0	4	4	0	2	
Dadar & Nagar Haveli	0	15	15	0	17	
Daman & Diu	18807	0	18807	26850	0	2
Delhi	0	4200	4200	0	4420	4
Lakshadweep	10550	0	10550	13540	0	13
Pondicherry	38420	4104	42524	38595	4108	4
Deep Sea Fishing Sector	30000	0	30000	30000	0	30
Total	2950444	2438028	5388472	2696459	2565790	52622

Source : Department of Animal Husbandary and Dairying, Ministry of Agriculture.

TABLE 3.3.14 : INLAND FISHERY WATER RESOURCES OF INDIA, 1995

S. No.	State/Uts.	Length Of Rivers & Canals (Km.)	Area Of Reservoirs (Lakh Sq. Km.)	Area Under Tanks & Ponds (Lakh Sq. Km.)	Beels Oxbow & Derelict Water (Lakh Sq. Km.)	Brackish Water (Lakh Sq. Km.)
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
12	Jammu & Kashmir	27781	0.0007	0.0017	0.0006	Nil
13	Manipur	9000	0.0220	0.0414	Nil	0.0008
14	Meghalya	3092	0.0030	0.0030	0.0243	0.0243
15	Nagaland	[illegible]	0.0294	0.0119	Nil	Nil
16	Orissa	4500	[illegible]	0.0050	Nil	0.0010
17	Punjab	15270	Neg.	[illegible]	0.0040	Nil
18	Rajasthan	NA	0.0120	0.0180	[illegible]	Nil
19	Sikkim	900	Nil	Nil	0.0003	[illegible]
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	Arunachal 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 3.3.15 : 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	[illegible]
9	West Bengal	17	47	[illegible]	45
10	Andaman & Nicobar	35	11	10	132
11	Pondicherry	0	7	31	27
12	Lakshadw[illegible]	506	2333	3726	8041

[illegible]and book on Fisheries Statistics 1996, Department of Agriculture and Cooperation.

Seagrass Ecosystem Palk Bay. Tamilnadu

CHAPTER FOUR

ATMOSPHERE

4.1 ATMOSPHERIC POLLUTION – MAIN SOURCES

The atmosphere consists of a mixture of gases that completely surround the earth. It extends to an altitude of 800 to 1000 km above the earth's surface, but is deeper at the equator and shallow at the poles. About 99.9% of the mass occurs below 50 Km and 0.0997% between 50 and 100 km altitude. Major polluting gases/ particles are confined to the lowermost layer of atmosphere known as Troposphere. That extends between 8 and 16 Km above the earth surface.

The **main sources of atmospheric pollution** may be summarized as follows :

(a) The combustion of fuels to produce energy for heating and power generation both in the domestic sector as well as in the industrial sector.

(b) The exhaust emissions from the transport vehicles that use petrol, or diesel oil etc.

(c) Waste gases, dust and heat from many industrial sites including chemical manufacturers, electrical power generating stations etc.

ENVIRONMENT POLLLUTION DUE TO ENERGY USE

A considerable amount of air pollution results from burning of fossil fuels. Fuels are primarily derived from fossilized plant material and consist mainly of carbon and/or its compounds. The household sector is the largest consumer of energy in India, accounting for 40-50% of the total energy consumption. As per a report of Planning Commission the share of the household sector in the final use of energy declined although retaining its dominant share at 58.9% in 1987. The most abundantly used fossil fuel for cooking is the wood, which is almost 61% of the total fuel demand for cooking. Burning of traditional fuels introduces large quantities of CO_2 when the combustion is complete, but if there is incomplete combustion and oxidation then Carbon monoxide (CO) is produced, in addition to hydrocarbons. Incomplete combustion of coal produces smoke consisting of particles of soot or carbon, tarry droplets of unburnt hydrocarbons and CO. Fossil fuels also contain .5 – 4.0% of sulphur which is oxidized to SO_2 during combustion.

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. Due to limited reserves of petroleum, main emphasis needs to be given to non-conventional energy sources such as wind energy, solar energy and ocean energy.

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 . The industrial units in India are largely located in the States of Gujarat, Maharastra, Uttar Pradesh, Bihar, West Bengal and Madhya Pradesh. The highest concentration of sulpher dioxide and oxides of nitrogen is therefore often found in cities located in these states. Some other industrial estates in Delhi, Punjab, Rajasthan and Andhra Pradesh are also becoming critical.

ROAD TRANSPORT

Road vehicles are the second major source of pollution. They emit CO, HCs, NO_X, SO_2, and other toxic substances such as TSP and lead. Diesel engines are much less polluting than petrol engines. Both types of engines are not very efficient converters of fuel energy. However, diesel types, with a conversion efficiency of around 30%, must be more efficient and use less fuel than petrol types with a 15-20% conversion efficiency. Both types of engines have incomplete combustion of fuel so the major pollutant is CO, amounting to 91% by weight of all vehicle emissions.

The primary pollutants produced in vehicle emissions undergo a series of complex interrelated chemical reactions in the troposphere and lower stratosphere to form secondary products.

Four factors make pollution from the vehicles more serious in developing countries :

i) Poor quality of vehicles creating more particulates and burning fuels inefficiently.

ii) Lower quality of fuel being used leads to far greater quantities of pollutants.

iii) Concentration of motor vehicles in a few large cities

iv) Exposure of a larger percentage of population, that lives and moves in the open.

HARMFUL EFFECTS OF EMISSIONS :

The high concentration of particulates in the atmosphere over large urban and industrial areas can produce a number of general effects. Smoke and fumes can increase the atmospheric turbidity and reduce the amount of solar radiation reaching the ground. The overall effect of air pollution upon the biosphere and the built environment can be broadly considered under 3 headings: The effect upon

i) buildings and materials

ii) soil, vegetation, crops and animal life

iii) human beings

i) **Buildings and Materials**: The fabric of buildings, that are surrounded by heavily polluted air for years undergo chemical changes. Gradual erosion takes place and this is only too

evident when grimy upper surface is removed. A good example is that of the famous historical monument 'Taj Mahal' at Agra, which, on account of reaction of Sulphur-dioxide, emitted from neighbouring industries, with the limestone has slowly, started turning yellow. As a result, on Court's directives, a number of measures have been taken to protect our national heritage monument e.g. closure of neighbouring heavy polluting industries, operation of only non-polluting vehicles like battery buses, tonga in the vicinity of Taj Mahal etc.

ii) **Soil, vegetation and Animal Life:** The presence of gaseous pollutants in the air and deposition of particulates on to the soil can effect plants. It can effect the cattle and animals too as they have been found to develop breathing difficulties and suffer from low yield of milk, lameness and joint stiffness in a polluted environment.

iii) **Human beings:** Smoke and SO_2 cause the general and most widespread effects of air pollution on people. Atmospheric smoke contains potentially carcinogenic organic compounds similar to those that occur in cigarette tobacco smoke. The CO affects the cardiovascular system, NO_xs affect the respiratory system, Ozone causes increased sensitivity to infections, lung diseases, irritation in eyes, nose and throat etc.

STEPS TAKEN SO FAR AND THEIR IMPACT

With the alarming increase in the atmospheric pollution, especially in the big cities, Government has taken some important initiatives in the recent years. To start with the emphasis and implementation has been primarily in the big cities but gradually to spread throughout the country. These relate to the progressive tightening of the auto-emission norms (1991,1996,1998 & 2000) and fuel quality specifications (1996) as recommended by the Central Pollution Control Board (CPCB).

Till early 1994 ambient air quality standards in India were based on 8 hourly average time only. In April, 1994, these standards were revised and 24 hourly standards were also prescribed. National ambient air quality standards are prescribed for three distinct areas viz., i) industrial, ii) residential, rural and other areas and iii) sensitive areas.

Following steps have been taken so far:

i) **Unleaded Petrol**: With the gradual reduction of lead content in petrol and finally supply of unleaded petrol for all vehicles from Sept. 1998 in the capital city of Delhi, a lethal pollutant from vehicular exhaust has been removed. The lead content in the atmosphere near traffic intersections of Delhi has reduced by more than 60% with this measure.

ii) **Sulphur in diesel**: The sulphur content in the diesel supplied in Delhi has been reduced from 0.5% in 1996 to 0.25% in 1997 so as to meet the EURO-II norms.

iii) **Tightening of the Vehicular Emission Norms**: From 1995 new passenger cars were allowed to register only if they were fitted with catalytic converters. Emission norms for such cars were tightened by 50% as compared to 1996 norms. With the recent directions of the Hon'ble Supreme Court, passenger cars (both petrol and diesel) are required to meet atleast EURO-I norms in June 1999 and from Apr. 2000 only such vehicles meeting EURO-III norms will be permitted to register in the NCR of Delhi. CNG operated vehicles are also permitted by the Supreme Court directions.

iv) **2-T Oil for Two stroke engines**: From 1.04.99, on the recommendations of CPCB, the low smoke 2T oil became effective. To prevent the use of 2T oil in excess of the required quantity, premixed 2T oil dispensers have been installed in all the petrol filling stations of Delhi. Sale of loose 2T oil has also been banned from Dec. 1998.

v) **Phasing out of Grossly Polluting Vehicles:** On CPCB's recommendations initially 20 yr. old vehicles were prohibited from plying from Dec.1998, followed by phasing out of 17 yr. old vehicles from Nov.98 and 15 yr. old from Dec. '98.

IMPACT ON POLLUTION LOAD AND AIR QUALITY IN DELHI

The major impacts have been observed through the implementation of emission norms and fuel quality specifications effective from 1996, as also phasing out of 15 year old commercial vehicles and leaded petrol in the year 1998 and phasing out of 8 year old commercial vehicles and 15 year old two wheelers from 2000 onwards. The ambient air quality as monitored by CPCB during 1999, shows reduction in levels of various pollutants in ambient air as compared to previous year. The reducing trend was observed with respect to Carbon Monoxide, nitrogen dioxide, and lead in residential areas.

NOISE POLLLUTION

Of late, noise has been recognized 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 55dB(A) and 45dB(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 for silence zones. Special campaign for reduction in use of fire crackers in Delhi have resulted in reduced pollution levels during Diwali in 1999.

4.2 GREEN HOUSE GASES AND THEIR EFFECTS

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 vapor, 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 concentration 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 chloroflouro carbons 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 concentration. Such a rise in the atmospheric concentration of GHG's has led to an upward trend in global temperature.

While it is required to follow the general commitments under the Framework Convention on Climate Change, India is not required to adopt any GHG reduction targets. Irrespective of international commitments, it seems prudent to ready with

- Inventory of sinks and sources of GHG emission
- Predict the cumulative impact of national and international GHG emissions to plan for temperature and sea level rise
- Devise land use plans for the coastal areas likely to be affected
- Devise water and land management strategies especially agricultural sector

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 : Ministry of Environment and Forests.

TABLE 4.1.2 : NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant	Sulphur Dioxide (SO_2)		Oxides of Nitrogen (NO_2)		Suspended Particulate Matter (SPM)		Respirable Particulate Matter (RPM) (size less than 10 microns)		Lead		Carbon Monoxide (CO)		Ammonia #	
Time Weighted Average	Annual* Average ($\mu g/m^3$)	24 hours** Average ($\mu g/m^3$)	Annual* Average ($\mu g/m^3$)	24 hours** Average ($\mu g/m^3$)	Annual* Average ($\mu g/m^3$)	24 hours** Average ($\mu g/m^3$)	Annual* Average ($\mu g/m^3$)	24 hours** Average ($\mu g/m^3$)	Annual* Average ($\mu g/m^3$)	24 hours** Average ($\mu g/m^3$)	8 hours** Average ($\mu g/m^3$)	1 hour Average ($\mu g/m^3$)	Annual* Average (mg/m^3)	24 hours** Average (mg/m^3)
Industrial Area	80	120	80	120	360	500	120	150	1.00	1.50	5.00	10.00	0.10	0.40
Residential, Rural and Other Area	60	80	60	80	140	200	60	100	0.75	1.00	2.00	4.00	0.10	0.40
Sensitive Area	15	30	15	30	70	100	50	75	0.50	0.75	1.00	2.00	0.10	0.40
Methods of Measurement	1. Improved West & Gaeke Method 2. Ultraviolet Fluorescenece		1. Jacob & Hochheiser Modified (Na-arsenic) Method 2. Gas phase Chemiluminiscence		High volume sampling (Above flow rate not less than 1.1 m3/minute)		Respirable particulate matter sampier		AAS Method after sampling using EPM 2000 or equivalent filter paper		Non-Dispresive infrared infrared Spectroscopy			

Source : 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 time, it may exceed but not on two consecutive days.

: Included vide notification SO. 955 (E), Air (Prevention & Control of Pollution) Act, 1981 dated October 14, 1998.

Note :

1. National Ambient Air Quality Standards : The level of air quality necessary with an adequate margin of safety necessary 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 standards for H_2S and CS_2 have been notified seqerately vide GSR No. 7, dated December 22, 1998 under Rayon Industry.

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

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

TABLE 4.1.4 :AMBIENT AIR QUALITY STATUS IN SOME CITIES/TOWNS DURING 1997-98

Pollution Level	Annual Mean Concentration Range (microgram per cubic metre)			
	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			
	I*		R**		I*		R**		I*		R**	
Area class	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997
Andhra Pradesh												
Hyderabad	L	L	L	M	L	M	M	L	H	M	H	H
Vishakhapatnam	L	L	L	M	L	M	L	C	L	L	H	C
Bihar												
Jharia	M	M	—	—	M	M	—	—	H	H	—	—
Dhanbad	—	—	H	M	—	—	M	M	—	—	C	H
Jamshedpur	—	—	—	—	—	—	—	—	L	—	—	—
Patna	—	—	L	L	—	—	L	M	—	—	C	
Sindri	M	M	—	—	M	M	—	—	L	M	—	
Delhi	L	L	L	L	M	M	M	M	H	H	C	
Gujarat												
Ahmedabad	—	L	—	L	—	L	—	M	—	—	—	—
Himachal Pradesh												
Shimla	—	—	L	L	—	—	L	L	—	—	M	M
Damtal	L	—	—	—	L	—	—	L	L	—	—	H
Parwanoo	—	—	—	—	L	—	L	L	L	—	C	M
Paonta Sahib	—	—	—	—	L	L	—	—	M	M	—	—
Haryana												
Yamuna Nagar	L	L	—	—	L	L	—	—	M	L	—	—
Faridabad	L	—	—	—	L	—	—	—	H	—	—	—
Maharashtra												
Dombivali	L	L	M	L	L	L	M	L	—	L	—	M
Mumbai	L	L	L	L	L	L	L	M	L	—	—	—
Chandrapur	M	L	M	M	M	M	M	M	L	L	H	M
Nagpur	L	L	L	L	L	L	L	L	L	L	H	H

TABLE 4.1.4 : AMBIENT AIR QUALITY STATUS IN SOME CITIES/TOWNS DURING 1997-98—Contd.

State/City	Sulphur Dioxide				Nitrogen Dioxide				SPM			
	I*		R**		I*		R**		I*		R**	
Area class	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997
Nasik	L	—	M	—	L	—	M	—	L	—	H	—
Pune	M	—	M	—	M	—	M	—	H	—	C	—
Solapur	—	—	L	—	—	—	M	—	—	—	C	—
Thane	L	—	L	—	L	—	M	—	L	—	H	—
Kerala												
Cochin	L	L	L	L	L	L	L	L	H	L	—	—
Kottayam	L	L	—	—	L	L	—	—	L	L	—	—
Kozhikode	L	L	L	L	L	L	L	L	L	L	M	M
Thiruvananthapuram	L	L	L	L	L	L	L	L	L	M	H	M
Madhya Pradesh												
Bhilai	L	L	L	M	L	L	M	M	H	M	C	H
Bhopal	L	L	L	L	L	L	M	M	H	M	C	C
Indore	L	L	L	L	L	L	L	L	H	M	C	C
Jabalpur	—	—	—	—	—	—	L	L	—	—	H	M
Korba	—	—	L	L	—	—	L	L	—	—	H	H
Nagda	M	H	M	H	L	M	M	L	L	L	H	M
Satna	L	L	L	L	L	L	L	L	M	M	H	H
Raipur	L	L	L	L	M	L	L	L	C	L	M	H
Orissa												
Angul	—	—	L	—	—	—	L	—	—	—	H	M
Rourkela	L	L	M	L	L	L	M	L	L	L	H	—
Rayagada	L	—	—	—	L	—	—	—	L	—	—	—
Talchar	L	—	—	—	L	—	—	—	L	—	—	—
Punjab												
Gobindgarh	—	L	—	—	—	M	—	—	—	M	—	—
Jalandhar	—	—	—	L	—	—	—	M	—	—	—	C
Ludhiana	—	L	—	L	—	M	—	M	—	M	—	C
Rajasthan												
Alwar	L	L	L	L	H	M	H	H	M	H	C	C
Jaipur	L	L	L	L	L	L	L	L	M	—	C	H
Kota	L	L	L	L	L	M	L	M	M	L	C	H

TABLE 4.1.4 : AMBIENT AIR QUALITY STATUS IN SOME CITIES/TOWNS DURING 1997-98—Concld.

State/City	Sulphur Dioxide				Nitrogen Dioxide				SPM			
	I*		R**		I*		R**		I*		R**	
Area class	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997
Jodhpur	L	—	L	—	L	—	L	—	M	—	C	—
Udaipur	—	—	L	—	H	M	H	M	H	M	C	C
Chittor	—	—	—	—	—	—	—	—	M	—	—	—
Tamil Nadu												
Tuticorin	—	—	—	L	L	—	L	L	L	—	M	M
Chennai	L	L	L	—	L	L	L	—	L	L	M	—
Coimbatore	—	—	L	—	—	—	L	—	—	—	M	—
Salem	—	—	—	—	—	—	L	—	—	—	M	—
Madurai	—	—	—	—	L	—	M	—	L	—	C	—
Uttar Pradesh												
Anpara	M	M	—	—	M	M	—	—	M	M	—	—
Gajraula	—	—	—	—	—	—	—	—	M	—	C	C
Kanpur	L	L	L	L	L	L	L	L	H	—	C	C
Luknow	L	L	M	M	L	L	M	M	H	M	C	C
Agra	L	—	L	—	L	—	L	—	C	—	C	—
Dehradun	L	—	L	—	L	—	L	—	—	—	C	—
Varanasi	—	—	—	—	—	—	—	—	—	—	C	—
West Bengal												
Calcutta	M	—	M	L	L	—	M	L	M	—	C	C
Chandigarh	L	L	L	L	L	L	L	L	M	M	C	C

Source: Central Pollution Control Board
I* : Industrial
R** : Residential

TABLE 4.1.5 : NUMBER OF MOTOR VEHICLES REGISTERED IN INDIA (TAXED AND TAX-EXEMPTED)

(As on 31st March) (In Number)

Year/State/ Union Territory	Two-wheelers	Auto-rick-shaws	Jeeps	Cars	Taxis	Buses	Goods vehicles (1)	Misce-llaneous (2)	Total No. of vehicles
1990-91	14199858	617365	443734	2266506	243748	331100	1512884	1759005	21374200
1991-92	15660801	669538	480922	2461519	262338	358165	1643729	1970401	23507413
1992-93	17183224	720364	512602	2550286	297941	363962	1752536	2124433	25505348
1993-94	18898701	771117	552038	2654232	362622	392148	1828117	2200903	27659878
1994-95	20831428	897383	614567	2875651	350331	423383	1938422	2769990	30294656
1995-96	23252287	1010344	671682	3150951	381011	448415	2030728	2837302	33782720
1996-97	25693206	1165140	725524	3520660	415740	488169	2260052	2747049	37447526
1996-97									
State:									
Andhra Pradesh	2232593	68188	38961	140124	20719	27377	170417	84904	2818115
Arunachal Pradesh	10605	1430	2260	2340	299	665	2878	488	21323
Assam	207367	10207	11414	41411	6825	10293	60386	14009	394310@
Bihar	978195	42042	39814	92106	30152	19002	89212	114153	1425444
Goa	174645	2418	$	34003	4994	2668	20217	415	245040
Gujarat	2639731	164272	66368	285904	29614	35076	248447	300401	3784133
Haryana*	613117	12180	26125	63038	500	9635	72237	253806	1079656
Himachal Pradesh	69726	1813	6690	12110	8846	5268	22224	6568	134671
Jammu & Kashmir	121227	12608	7599	27377	4586	12623	22083	6179	218952
Karnataka	1798772	119379	36889	231322	21277	39816	121693	160058	2557514
Kerala	693768	148801	47756	191687	66036	34815	130829	16519	1378995
Madhya Pradesh	1919075	32117	49051	103877	8242	45444	115972	285379	2578555
Maharashtra	2962445	272855	147543	469286	66166	44765	299833	241221	4527378
Manipur	46229	1987	4821	3525	303	1742	5282	1225	65432
Meghalaya	13703	399	7408	8274	2801	1955	10570	2484	48396
Mizoram	7901	-	5240	1668	1600	634	2921	330	20326
Nagaland	21786	7163	21925	21268	2121	3302	25507	2926	109122
Orissa	562212	6270	23411	31276	4936	10842	52805	26378	734940
Punjab	1463689	20419	18610	104305	5122	14997	77605	387316	2097175
Rajasthan	1325605	36862	74698	91965	14476	36443	107899	294608	1988508
Sikkim	3250	-	1524	523	2119	288	897	-	10947
Tamil Nadu	2454061	68381	26186	319401	24508	37806	177117	60660	3195518
Tripura	19056	2231	3432	3742	526	1320	4949	1094	37184

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TABLE 4.1.7 : WORKING OF STATE TRANSPORT UNDERTAKINGS

(As on 31st March)

Year/State/ Union Territory	Fleet strength (Buses) (no.)	Vehicles in bus scheduled service (no.)	Kilometers performed (lakh km.)	Gross revenue receipts (Rs.lakh)	Current expenditure (total operating cost) (Rs.lakh)	Net revenue (Rs.lakh)
1990-91	100182	85481	3766032	509351	571019	-61668
1991-92	96909	85099	3956416	608679	669574	-60895
1992-93	105214	92089	4152713	691882	763124	-71242
1993-94	102913	91835	4111659	777344	842947	-65603
1994-95	90566	80213	3713205	613420	688359	-74939
1995-96	91144	80572	3916078	657591	759655	-102064
1996-97	88479	78896	3816364	632465	735700	-103234
1997-98	101514	91916	4067927	831140	941947	-110807
1998-99	105336	95092	4243137	902597	1080743	-178147
1998-99						
State :						
Andhra Pradesh	18122	17792	742107	..	..	..
Arunachal Pradesh	..	..	..	..	..	..
Assam	..	..	..	..	..	..
Bihar	1370	116	3009	972	5311	-4339
Goa	..	..	..	..	..	..
Gujarat (1)	10069	8795	410919	97065	125670	-28605
Haryana	3801	3630	133807	43433	52770	-9337
Himachal Pradesh	1763	1724	..	16808	20455	-3648
Jammu & Kashmir	..	..	..	..	..	..
Karnataka	5497	5174	253376	59364	61836	-2472
Kerala	..	..	..	..	..	..
Madhya Pradesh	2159	1766	60768	20521	25959	-5439
Maharashtra (2)	21204	19393	719659	243988	283696	-39708
Manipur	..	..	..	..	..	..
Mizoram	..	..	..	..	..	..

TABLE 4.1.7 : WORKING OF STATE TRANSPORT UNDERTAKINGS—Concld.

(As on 31st March)

Year/State/ Union Territory	Fleet strength (Buses) (no.)	Vehicles in bus scheduled service (no.)	Kilometers performed (lakh km.)	Gross revenue receipts (Rs.lakh)	Current expenditure (total operating cost) (Rs.lakh)	Net revenue (Rs.lakh)
Meghalaya	146	56	1014	623	842	-219
Nagaland	..	..	..	..	..	..
[illegible]a	748	305	8738	2208	3726	-1518
Punjab (3)	3437	3267	99992	34359	43944	-9585
Rajasthan	5018	4418	167385	51300	55817	-4517
Sikkim	..	..	..	..	..	..
Tamil Nadu (4)	16668	15204	1147297	211715	247608	-35890
Tripura	94	42	725	159	664	-505
Uttar Pradesh	7841	7159	243974	66297	68057	-1760
West Bengal (5)	1925	1317	38589	8308	18774	-10466
Union Territory:						
A.& N. Islands	..	..	..	..	..	..
Chandigarh (6)	415	391	19190	4467	4869	-402
Delhi (7)	5059	4543	192588	41010	60748	-19738

Source : Transport Research Wing, Ministry of Surface Transport

(1) Relates to Gujarat SRTC, Ahmedabad MTS.

(2) Relates to Maharastra SRTC, BEST Undertaking, Kolhapur MTU, Pune MT, Pimpri-Chin.MT, Solapur MT.

(3) Relates to Pepsu RTC and Punjab Roadways.

(4) Relates to Metro.TC(Chennai Dvn-I) Ltd, Metro.TC(Chennai Dvn-II) Ltd, State Exp.TC(TN Dvn-I)Ltd, State Exp.TC(TN Dvn-II) Ltd, TN STC(Coimbatore Dvn-I) Ltd, TN STC (Coimbatore Dvn-II)Ltd, TN STC(Coimbatore Dvn-III) Ltd, TN STC(Kumakonam Dvn-I) Ltd, TN STC (Kumakonam Dvn-II)Ltd, TN STC(Kumakonam Dvn-III) Ltd, TN STC (Kumakonam Dvn-IV)Ltd, TN STC (Madurai Dvn-I)Ltd, TN STC(Madurai Dvn-II) Ltd, TN STC (Madurai Dvn-III)Ltd, TN STC (Madurai Dvn-IV)Ltd, TN STC(Salem Dvn-I)Ltd,TN STC(Salem Dvn-II)Ltd,TN STC(Villupuram Dvn-I)Ltd, TN STC(Villupuram Dvn-II)Ltd, TN STC (Villupuram-III) Ltd, Kadamba TCL.

(5) Relates to Calcutta STC, North Bengal STC. (6) Relates to Chandigarh TU only.

(7) Relates to DTC, Delhi only.

CHART 6 : COMPARISON OF POLLUTION LOAD IN DELHI WITH MEASURE

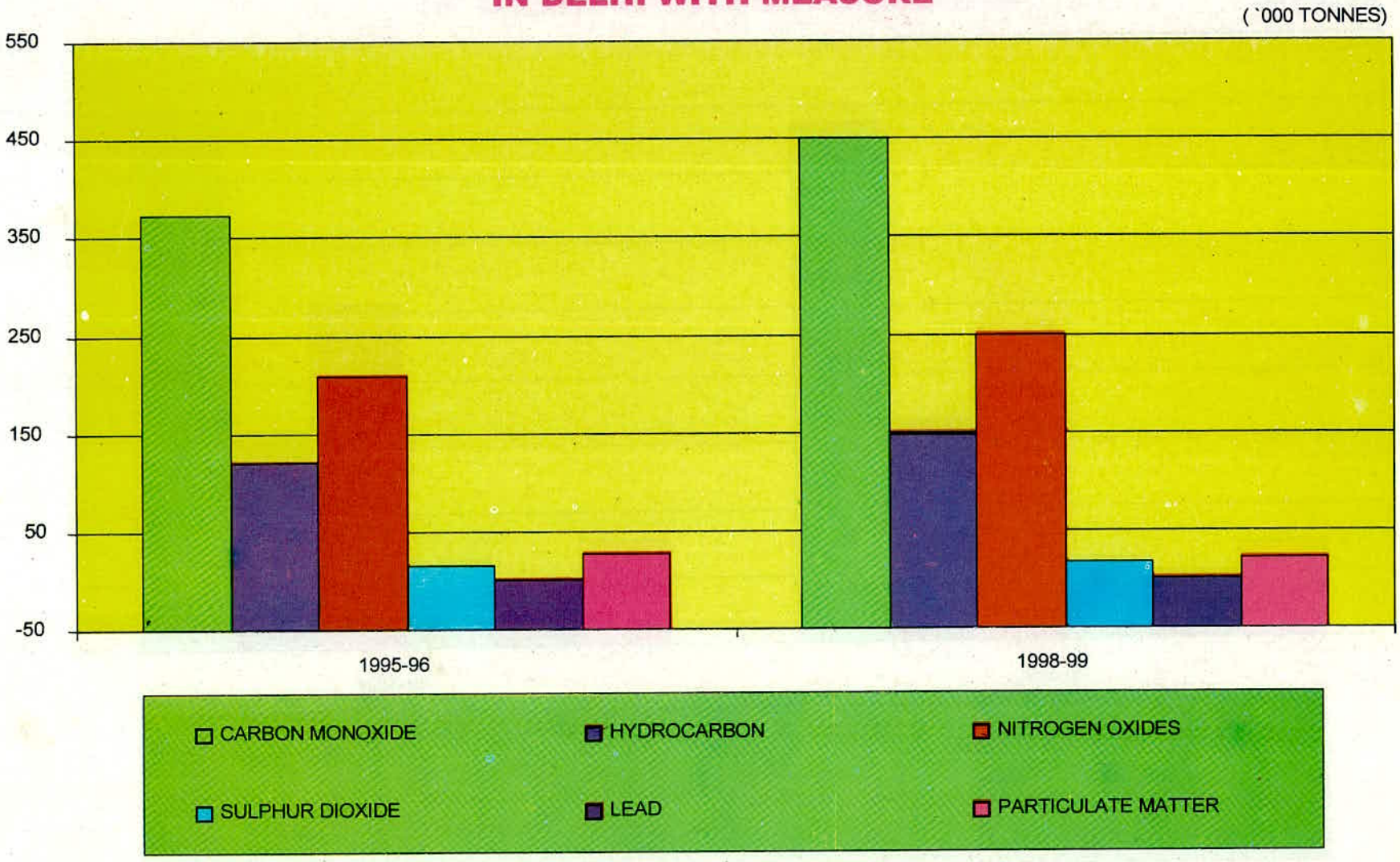

TABLE 4.1.12: PHASED TIGHTENING OF EXHAUST EMISSION STANDARDS FOR INDIAN AUTOMOBILES

Category	1991	1996	2000(Euro I)	2005(Euro II)
Petrol Vehicles : (in grams/km)				
Two wheelers				
(a) CO	12-30	4.5	2.0	-
(b) HC	8-12	-	-	-
(c) ($HC+NO_x$)	-	3.6	2.0	-
Three Wheelers				
(a) CO	12-30	6.75	4.0	-
(b) HC	8-12	-	-	-
(c) ($HC+NO_x$)	-	5.40	2.0	-
Cars with CC :				
(a) CO	-	4.34-6.20	2.72	2.2
(b) HC	-	-	-	-
(c) ($HC+NO_x$)	-	1.5-2.18	0.97	0.5
Cars without CC :				
(a) CO	14.3-27.1	8.68-12.4	2.72	2.2
(b) HC	2.0-2.9	-	-	-
(c) ($HC+NO_x$)	-	3.00-4.36	0.97	0.5
Diesel Vehicles :				
Gross Vehicles Weight > 3.5 ton (Heavy Duty Vehicles)-in grams/KWH				
(a) CO	14.0	11.2	4.5	4
(b) HC	3.5	2.4	1.1	1.1
(c) NO_x	18.0	14.4	8.0	7
(d) PM > 85 KW/g/KWH	-	-	0.36	0.15
(e) PM < 85 KW/g/KWH	-	-	0.61	0.15
B : Gross Vehicles Weight < 3.5 ton (Light duty Vehicles)*-in grams/km				
(a) CO	14.3-27.1	5.0-9.0	2.72-6.90	1.06
(b) ($HC+NO_x$)	2.7-6.9	2.0-4.0	0.97-1.70	0.71
(c) NO_x	-	-	-	0.566
(d) PM	-	-	0.14-0.25	0.080

Source : Tata Energy Research Institute

CO : Carbon Monoxide
CC : Catalytic Converter.
HC : Hydrocarbon.
PM : Particulate matter.
NO_x : Oxides of Nitrogen.

* : The test cycle is as per 13 mode cycle or a chasis dynamometer.

Euro I w.e.f. 1-6-99 and Euro II w.e.f. 1-4-2000 for private (non-commercial) vehicles in NCR.

Stricter emission norms for new vehicles effective from 1.4.2000 have been notified by the Ministry of Surface Transport and has come into force. The Progressive tightening of emission norms for vehicles at manufacturing stage has brought about significant improvement in exhaust emission of new vehicles after March, 2000.

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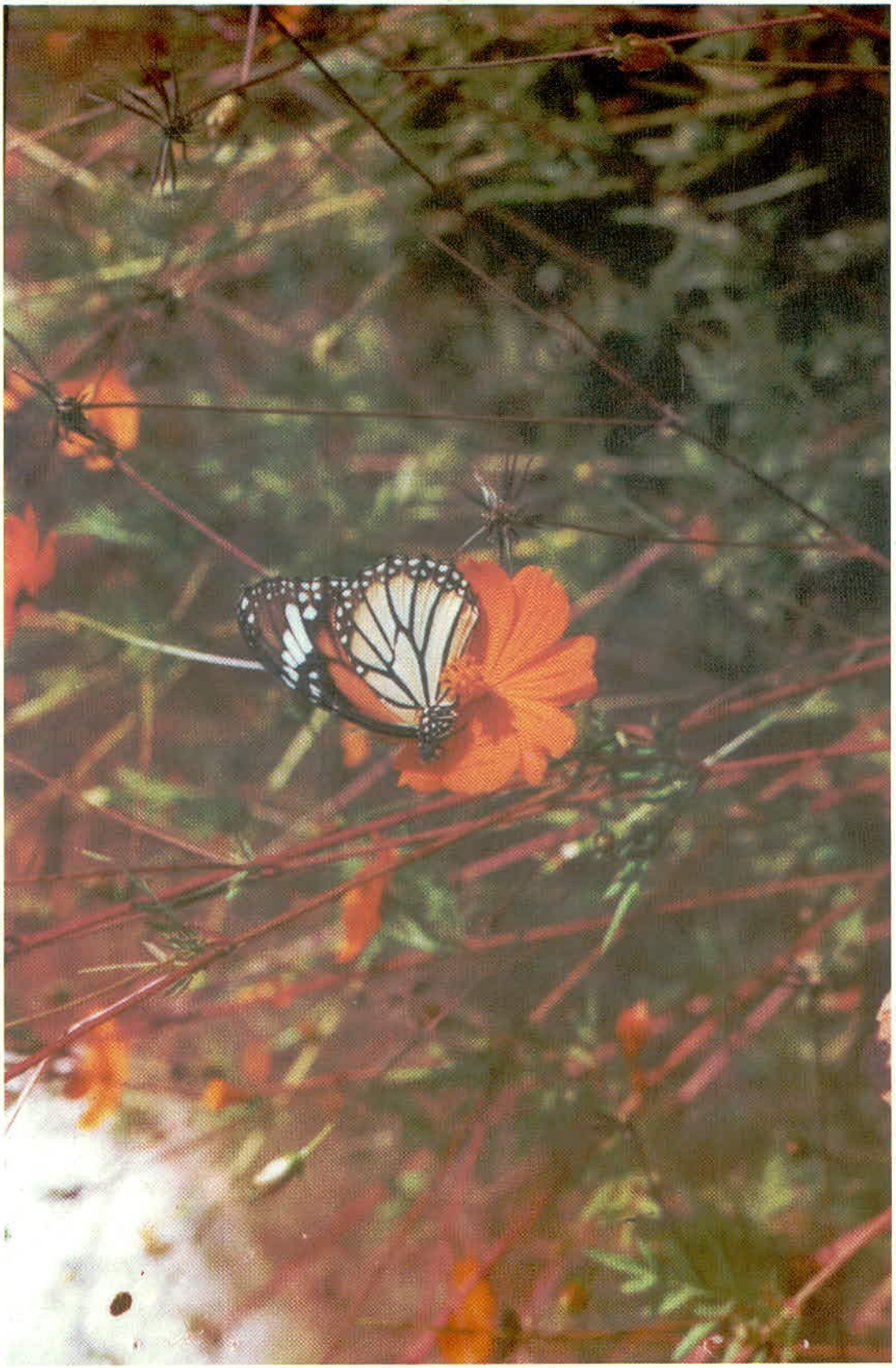

Butterly - Tasting nectar from the flower

TABLE 4.1.13 : 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, unburnt hydrocarbons and oxides of nitrogen.

TABLE 4.2.3 : ACTUAL POWER SUPPLY POSITION

(All figures in MU net)

Region/ State/ System	April 1999-March 2000				April 2000 to May 2000			
	Require-ment	Avail-ability	Shortage	Shortage %	Require-ment	Avail-ability	Shortage	Shortage %
Northern Region								
Chandigarh	1033	1032	1	0.1	189	189	0	0.0
Delhi	17635	17141	494	2.8	3275	3131	144	4.4
Haryana	15950	15578	372	2.3	2520	2499	21	0.8
Himachal Pradesh	3125	3115	10	0.3	505	505	0	0.0
Jammu & Kashmir	6065	4903	1162	19.2	1070	891	179	16.7
Punjab	26335	26164	171	0.6	4290	4281	9	0.2
Rajasthan	25155	24024	1131	4.5	4080	3812	268	6.6
Uttar Pradesh	44525	38800	5725	12.9	7620	6627	993	13.0
Total	**139823**	**130757**	**9066**	**6.5**	**23549**	**21935**	**1614**	**6.9**
Western Region								
Gujarat	51202	46994	4208	8.2	9570	8534	1036	10.8
Madhya Pradesh	37198	34543	2655	7.1	6472	5796	676	10.4
Maharashtra	73498	69002	4496	6.1	13848	12192	1656	12.0
Goa	1806	1414	392	21.7	311	267	44	14.1
Total	**163704**	**151953**	**11751**	**7.2**	**30201**	**26789**	**3412**	**11.3**
Southern Region								
Andhra Pradeash	45835	42832	3003	6.6	7805	6952	853	10.9
Karnataka	28201	25851	2350	8.3	5260	4603	657	12.5
Kerala	12850	11908	942	7.3	2332	2134	198	8.5
Tamil Nadu	38873	35797	3076	7.9	7206	6324	882	12.2
Total	**125759**	**116388**	**9371**	**7.5**	**22603**	**20013**	**2590**	**11.5**
Eastern Region								
Bihar	8912	8348	564	6.3	1443	1366	77	5.3
D.V.C.	8464	8668	-204	-2.4	1422	1450	-28	-2.0
Orissa	10838	11143	-305	-2.8	1785	1889	-104	-5.8
West Bengal	17951	18298	-347	-1.9	3102	3137	-35	-1.1
Total	**46165**	**46457**	**-292**	**-0.6**	**7752**	**7842**	**-90**	**-1.2**
North-Eastern Region								
Arunachal Pradesh	119.8	120.7	-0.9	-0.8	21.0	20.8	0.2	1.0
Assam	2868.3	2918.4	-50.1	-1.7	446.3	457.7	-11.4	-2.6
Manipur	470.5	451.2	19.3	4.1	76.9	76.5	0.4	0.5
Meghalaya	514.1	540.8	-26.7	-5.2	83.7	86.8	-3.1	-3.7
Mizoram	220.8	223.9	-3.1	-1.4	36.1	36.2	-0.1	-0.3
Nagaland	205.6	207.8	-2.2	-1.1	33.2	33.4	-0.2	-0.6
Tripura	579.9	590.1	-10.2	-1.8	87.6	88.6	-1.0	-1.1
Total	**4979.0**	**5052.9**	**-73.9**	**-1.5**	**784.8**	**800.0**	**-15.2**	**-1.9**
All India	**480430.0**	**450607.9**	**29822.1**	**6.2**	**84889.8**	**77379.0**	**7510.8**	**8.8**

Source : Central Electricity Authority

TABLE 4.2.4 (a) : CONSUMPTION OF FOSSIL FUELS FOR ELECTRICITY GENERATION FROM THERMAL STATIONS (BY KIND OF FUELS) REGIONWISE/STATEWISE DURING 1997-98 (STEAM)

State/Union Territory	Steam 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.× Billion)	Gross Generation (GWH)	Average Heat Input (K.Cal./ Kwh)
Northern Region									
Haryana	2961000	0	8953	3722	33220	0.00	12212.018	3511.00	3478
Himachal Pradesh	0	0	0	0	0	0.00	0.000	0.00	0
Jammu & Kashmir	0	0	0	0	0	0.00	0.000	0.00	0
Punjab	7065000	0	0	2496	15297	0.00	27636.932	10286.00	2687
Rajasthan	3944000	0	9789	482	94	0.00	16268.351	5991.00	2715
Uttar Pradesh	14293000	0	37063	42874	1050	0.00	57672.935	18288.00	3154
Chandigarh	0	0	0	0	0	0.00	0.000	0.00	0
Delhi	1490000	0	1542	19739	12842	0.00	6277.622	1705.00	3682
Central sector	24001000	0	17658	11364	0	0.00	90452.593	36131.00	2503
Sub Total	**53754000**	**0**	**75005**	**80677**	**62503**	**0.00**	**210520.451**	**75912.00**	**2773**
Western Region									
Gujarat	13959000	939000	16336	6759	116806	0.00	54274.527	20128.00	2696
Madhya Pradesh	14326000	0	44416	13763	0	0.00	50059.088	17887.00	2799
Maharashtra	28201000	0	158729	11544	1160171	0.00	112176.992	36578.00	3067
Goa	0	0	0	0	0	0.00	0.000	0.00	0
Daman & Diu	0	0	0	0	0	0.00	0.000	0.00	0
Dadra & Nagar Haveli	0	0	0	0	0	0.00	0.000	0.00	0
Central sector	16473000	0	8491	1124	0	0.00	64864.252	24460.00	2652
Sub Total	**72959000**	**939000**	**227972**	**33190**	**1276977**	**0.00**	**281374.859**	**99053.00**	**2841**
Southern Region									
Andhra Pradesh	15117000	0	20583	5868	0	0.00	51745.261	19014.00	2721
Karnataka	3940000	0	4180	75	0	0.00	12769.540	5538.00	2306
Kerala	0	0	0	0	0	0.00	0.000	0.00	0
Tamil Nadu	13371000	0	79507	4264	0	0.00	46864.342	17687.00	2650
Pondicherry	0	0	0	0	0	0.00	0.000	0.00	0
Central sector	10655000	15618000	8507	1693	180276	0.00	39721.270	16398.00	2422
Sub Total	**43083000**	**15618000**	**112777**	**11900**	**180276**	**0.00**	**151100.413**	**58637.00**	**2577**

TABLE 4.2.4 (a) : CONSUMPTION OF FOSSIL FUELS FOR ELECTRICITY GENERATION FROM THERMAL STATIONS (BY KIND OF FUELS) REGIONWISE/STATEWISE DURING 1997-98 (STEAM)

State/Union Territory	Steam 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.× Billion)	Gross Generation (GWH)	Average Heat Input (K.Cal./ Kwh)
Eastern Region									
Bihar	2860000	0	27630	38431	0	0.00	11552.805	3190.00	3622
Orissa	1912000	0	0	9076	0	0.00	5846.452	2029.00	2890
West Bengal	9983000	0	1974	53722	0	0.00	45568.160	14443.00	3155
Damodar Valley Corporation	4875000	0	21595	82314	0	0.00	23877.596	6904.00	3459
Sikkim	0	0	0	0	0	0.00	0.000	0.00	0
Central sector	13183000	0	46506	2376	0	0.00	42720.393	15728.00	2716
Sub Total	**32813000**	**0**	**97705**	**185919**	**0**	**0.00**	**129565.406**	**42294.00**	**3063**
North-Eastern Region									
Assam	149000	0	13117	6146	0	0.00	918.615	203.00	4525
Manipur	0	0	0	0	0	0.00	0.000	0.00	0
Meghalaya	0	0	0	0	0	0.00	0.000	0.00	0
Nagaland	0	0	0	0	0	0.00	0.000	0.00	0
Tripura	0	0	0	0	0	0.00	0.000	0.00	0
Arunachal Pradesh	0	0	0	0	0	0.00	0.000	0.00	0
Mizoram	0	0	0	0	0	0.00	0.000	0.00	0
Central sector	0	0	0	0	0	0.00	0.000	0.00	0
Sub Total	**149000**	**0**	**13117**	**6146**	**0**	**0.00**	**918.615**	**203.00**	**4525**
Islands									
Lakshadweep	0	0	0	0	0	0	0.000	0	0
A & N Island	0	0	0	0	0	0	0.000	0	0
Sub Total	**0**	**0**	**0**	**0**	**0**	**0**	**0.000**	**0**	**0**
All-India	**202758000**	**16557000**	**526576**	**317832**	**1519756**	**0.00**	**773479.744**	**276099.00**	**2801**

Source : Central Electricity Authority

MT = Metric Tonnes KL = Kilo Litres

TABLE 4.2.4(b) : CONSUMPTION OF FOSSIL FUELS FOR ELECTRICITY GENERATION FROM THERMAL STATIONS (BY KIND OF FUELS) REGIONWISE/STATEWISE DURING 1997-98 (GAS & DIESEL)

State/Union Territory	Gas Stations				Diesel Stations		
	Natural Gas (M. Cu.Mts.)	HSD (KILO LTRS.)	Naphtha (Kilo Ltrs.)	Generation (GWH)	Diesel Oil (K.Ltrs.)	Generation (GWH)	Average Oil Consumed (Ltrs/Kwh)
Northern Region							
Haryana	0	0	0	0.00	0	0.00	0.00
Himachal Pradesh	0	0	0	0.00	0	0.00	0.00
Jammu & Kashmir	0	18334	0	49.40	3500 e	10.08	0.00
Punjab	0	0	0	0.00	0	0.00	0.00
Rajasthan	145	10492	0	234.94	0	0.00	0.00
Uttar Pradesh	0	0	0	0.00	0	0.00	0.00
Chandigarh	0	0	0	0.00	0	0.00	0.00
Delhi	257	33914	0	801.46	0	0.00	0.00
Central sector	2363 e	0	100199 e	11117.24	0	0.00	0.00
Subtotal	**2765**	**62740**	**100199**	**12203.04**	**3500**	**10.08**	**0.00**
Western region							
Gujarat	461	31325	0	4880.38	100 e	0.30	0.00
Madhya Pradesh	0	0	0	0.00	0	0.00	0.00
Maharashtra	2723 e	0	0	6162.82	0	0.00	0.00
Goa	0	0	0	0.00	0	0.00	0.00
Daman & Diu	0	0	0	0.00	0	0.00	0.00
Dadra & Nagar Haveli	0	0	0	0.00	0	0.00	0.00
Central sector	2969	0	0	6721.00	0	0.00	0.00
Subtotal	**6153**	**31325**	**0**	**17764.20**	**100**	**0.30**	**0.00**
Southern region							
Andhra Pradesh	1176 e	0	0	2662.63	0	0.00	0.00
Karnataka	0	0	0	0.00	130960	665.00	0.20
Kerala	0	0	0	0.00	27851	113.20	0.00
Tamil Nadu	10	18880	0	78.64	0	0.00	0.00
Pondicherry	0	0	0	0.00	0	0.00	0.00
Central sector	0	0	0	0.00	0	0.00	0.00
Subtotal	**1186**	**18880**	**0**	**2741.27**	**158811**	**778.20**	**0.20**
Eastern region							
Bihar	0	0	0	0.00	0	0.00	0.00
Orissa	0	0	0	0.00	0	0.00	0.00
West Bengal	0	7193	0	0.00	83	0.42	0.20
Damodar Valley Corpo.	2831 e	0	3067 e	19.63	0	0.00	0.00
Sikkim	0	0	0	14.24	207	1.05	0.20
Central sector	0	0	0	0.00	0	0.00	0.00
Subtotal	**2831**	**7193**	**3067**	**33.87**	**290**	**1.47**	**0.28**

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TABLE 4.2.4(b) : CONSUMPTION OF FOSSIL FUELS FOR ELECTRICITY GENERATION FROM THERMAL STATIONS (BY KIND OF FUELS) REGIONWISE/STATEWISE DURING 1997-98 (GAS & DIESEL)—Concld.

State/Union Territory	Gas Stations				Diesel Stations		
	Natural Gas (M. Cu.Mts.)	HSD (KILO LTRS.)	Naphtha (Kilo Ltrs.)	Generation (GWH)	Diesel Oil (K.Ltrs.)	Generation (GWH)	Average Oil Consumed (Ltrs/Kwh)
North-Eastern region							
Assam	311	0	0	703.94	0	0.00	0.00
Manipur	0	0	0	0.00	238	0.71	0.34
Meghalaya	0	0	0	0.00	0	0.00	0.00
Nagaland	0	0	0	0.00	35	0.25	0.14
Tripura	233	0	0	255.61	700	2.00	0.35
Arunachal Pradesh	0	0	0	0.00	3954 e	20.04	0.20
Mizoram	0	0	0	0.00	4845 e	14.24	0.34
Central sector	318	0	0	721.29	0	0.00	0.00
Subtotal	**862**	**0**	**0**	**1680.84**	**9772**	**37.24**	**0.25**
Islands							
Lakshadweep	0	0	0	0	6407	18.37	0.35
A & N Island	0	0	0	0	28390	95.18	0.29
Subtotal	**0**	**0**	**0**	**0**	**34797**	**113.55**	
All-India	**13797**	**120138**	**103266**	**34423.22**	**207270**	**940.84**	**0.22**

Source : Central Electricity Authority
e : Estimated

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TABLE 4.2.5 : 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	70462.7	233150.7	310.9	14727.6	5397.7	324049.6
1994-95	82712.0	243110.2	545.2	18474.8	5648.2	350490.4
1995-96	72759.2	273743.5	714.4	24858.4	7981.7	380057.2
1996-97	68900.8	289378.3	1554.3	26984.9	9071.1	395889.4
1997-98	74581.7	300730.5	1929.3	34423.2	10082.6	421747.3

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 42% in 1980-81 and further reduced to 23.5% in 1994-95 and to 17.7% in 1997-98.

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.

TABLE 4.2.8 : STATEWISE PRODUCTION OF COAL AND LIGNITE

(Million tonne)

States	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000
Coal						
Andhra Pradesh	25.04	26.77	28.73	28.94	27.32	29.55
Assam	1.19	0.82	0.75	0.68	0.63	0.57
Bihar	73.33	74.56	77.67	81.27	76.16	76.95
Jammu & Kashmir	0.02	0.01	0.02	0.00	0.01	0.02
Madhya Pradesh	74.86	79.76	83.28	84.75	84.93	87.94
Maharashtra	21.06	22.81	24.85	26.17	25.27	27.69
Orissa	27.32	32.70	37.36	42.16	43.51	43.55
Uttar Pradesh	13.81	14.80	15.39	15.78	15.64	16.20
West Bengal	17.23	17.91	17.99	17.39	18.76	17.58
Total Coal	**253.90**	**270.16**	**286.08**	**297.16**	**292.27**	**300.09**
Lignite						
Gujarat	3.84	4.94	5.18	4.94	5.00	4.34
Rajasthan					0.24	0.22
Tamilnadu	15.46	17.20	17.45	18.10	18.16	17.55
Total Lignite	**19.31**	**22.14**	**22.64**	**23.05**	**23.41**	**22.12**

Source : Coal Controller's Organisation.

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, 2000) have been assessed at about 212 billion tonnes of which 82 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 300 million ton in 1999-2000 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 4.2.9 : PRODUCTION OF COAL FROM OPENCAST WORKING BY MECHANISATION AND OVERBURDENED REMOVED DURING THE YEAR, 1998

(In Tonne)

State	Total Opencast Output	Mechanisation			Overburden Removed (in '000 Cubic metres)
		Fully Mechanised	Semi Mechanised	Manual	
COAL					
Andhra Pradesh	14626457	14626457	—	—	61639
Assam	421395	421395	—	—	2865
Bihar	61682940	61682940	—	—	110027
Madhya Pradesh	68990214	68990214	—	—	123298
Maharashtra	21164093	21164093	—	—	67446
Orissa	43056056	43056056	—	—	34243
Uttar Pradesh	10729500	10729500	—	—	17539
West Bengal	7327860	7327860	—	—	32237
All India	**227998515**	**227998515**	—	—	**449294**
LIGNITE					
Gujarat	5006477	5006477	—	—	15580
Rajasthan	229459	229459	—	—	350
Tamil Nadu	18090130	18090130	—	—	92730
All India	**23326066**	**23326066**	—	—	**108660**

Source : Statistics of Mines in India, Vol. I (Coal), 1998
Issued by - The Directorate -General of Mines Safety, Dhanbad

TABLE 4.2.10 : PRODUCTIVITY IN COAL MINES IN THE YEAR 1998

(In Tonne)

State	Output per man year			Out per manshift		
	Belowground	Opencast	Overall	Below-ground	Opencast	Overall
COAL						
Andhra Pradesh	241	3000	405	0.83	10.15	1.40
Assam	101	1978	205	0.33	6.40	0.65
Bihar	206	1929	465	0.67	6.04	1.49
Jammu & Kashmir	8	—	7	0.03	—	0.02
Madhya Pradesh	381	6164	966	1.18	18.18	2.97
Maharashtra	298	3664	752	0.94	11.29	2.35
Orissa	293	9828	2696	0.94	28.49	8.20
Uttar Pradesh	—	5325	2739	—	17.23	8.98
West Bengal	199	1839	201	0.65	5.81	0.65
All India	**254**	**3539**	**615**	**0.83**	**10.97**	**1.97**
LIGNITE						
Gujarat	—	4800	2947	—	16	9.83
Rajasthan	—	2295	1961	—	7.35	6.32
Tamil Nadu	—	5986	2563	—	19.22	8.24
All India	—	**5600**	**2629**	—	**18.15**	**8.51**

Source : Statistics of Mines in India, Vol. I (Coal), 1998
Issued by - The Directorate -General of Mines Safety, Dhanbad

TABLE 4.2.11 : STATEWISE INVENTORY OF GEOLOGICAL RESERVES OF COAL

(in Million Tonne)

State	As on	Proved	Indicated	Inferred	Total
Andhra Pradesh	1-1-1998	6988	3203	2936	13127
	1-1-1999	7095	3314	2929	13338
	1-1-2000	7346	3312	2929	13587
Arunachal Pradesh	1-1-1998	31	11	48	90
	1-1-1999	31	11	48	90
	1-1-2000	31	11	48	90
Assam	1-1-1998	228	27	65	320
	1-1-1999	259	27	34	320
	1-1-2000	259	27	34	320
Bihar	1-1-1998	33982	28116	5898	67996
	1-1-1999	34401	28421	5935	68757
	1-1-2000	34794	28692	5642	69128
Madhya Pradesh	1-1-1998	11389	21904	8824	42117
	1-1-1999	12502	21795	8474	42771
	1-1-2000	13010	22148	8334	43492
Maharashtra	1-1-1998	3810	1305	1664	6779
	1-1-1999	3928	1357	1684	6969
	1-1-2000	4149	1323	1605	7077
Meghalaya	1-1-1998	118	41	301	460
	1-1-1999	118	41	301	460
	1-1-2000	118	41	301	460
Nagaland	1-1-1998	3	1	15	19
	1-1-1999	3	1	15	19
	1-1-2000	3	1	15	19
Orissa	1-1-1998	7678	22768	17930	48376
	1-1-1999	9623	21991	17447	49061
	1-1-2000	11140	22755	16554	50449
Uttar Pradesh	1-1-1998	575	487	0	1062
	1-1-1999	575	487	0	1062
	1-1-2000	766	296	0	1062
West Bengal	1-1-1998	10315	11215	4362	25892
	1-1-1999	10570	10981	4352	25903
	1-1-2000	10779	10894	4236	25909
India	**1-1-1998**	**75117**	**89078**	**42043**	**206238**
	1-1-1999	**79105**	**88426**	**41219**	**208750**
	1-1-2000	**82395**	**89500**	**39698**	**211593**

Source : Coal Controller's Organisation

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TABLE 4.2.12 : INVENTORY OF GEOLOGICAL RESERVES OF COAL BY TYPE

(in Million Tonne)

Types of Coal	As on	Proved	Indicated	Inferred	Total
Gondwana coal	1-1-2000	81984	89423	39299	**210706**
Tertiary coal	1-1-2000	412	77	398	**887**
Total		**82396**	**89500**	**39697**	**211593**
Coking					
Prime coking	1-1-1998	4509.00	804.00		**5313.00**
	1-1-1999	4614.00	699.00		**5313.00**
	1-1-2000	4614.00	699.00	0.00	**5313.00**
Medium coking	1-1-1998	11111.00	10885.00	1215.00	**23211.00**
	1-1-1999	11251.00	10692.00	1215.00	**23158.00**
	1-1-2000	11267.00	11133.00	1106.00	**23506.00**
Blendable/semi-coking	1-1-1998	482.00	904.00	222.00	**1608.00**
	1-1-1999	482.00	904.00	222.00	**1608.00**
	1-1-2000	482.00	904.00	222.00	**1608.00**
Non-coking	1-1-1998	59016.00	76486.00	40606.00	**176108.00**
	1-1-1999	62759.00	76132.00	39783.00	**178674.00**
	1-1-2000	77299.00	87898.00	39475.00	**204672.00**
Total	**1-1-1998**	**75118.00**	**89079.00**	**42043.00**	**206240.00**
(Coking and Non-coking)	**1-1-1999**	**79106.00**	**88427.00**	**41220.00**	**208753.00**
	1-1-2000	**93662.00**	**100634.00**	**40803.00**	**235099.00**

Source : Coal Controller's Organisation.

TABLE 4.2.13 : 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	50,000 MW

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.

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TABLE 4.2.17 : AVAILABILITY OF CRUDE OIL AND PETROLEUM PRODUCTS IN INDIA

('000 Tonne)

Year	Crude oil			Petroleum products		
	Production	Net imports	Gross availability	Production	Net imports	Gross availability
1970-71	6822	11683	18505	17110	752	17862
1971-72	7299	12951	20250	18639	2011	20650
1972-73	7321	12084	19405	17830	3399	21229
1973-74	7189	13855	21044	19495	3387	22882
1974-75	7684	14016	21700	19603	2473	22076
1975-76	8448	13624	22072	20829	2048	22877
1976-77	8898	14048	22522	21432	2550	23982
1977-78	10763	14507	25270	23219	2832	26051
1978-79	11633	14657	26290	24193	3834	28027
1979-80	11766	16121	27887	25794	4636	30430
1980-81	10507	16248	26755	24123	7253	31376
1981-82	16194	14460	30654	28182	4829	33011
1982-83	21063	12397	33460	31073	4233	35306
1983-84	26020	10445	36465	32926	2856	35782
1984-85	28990	7164	36154	33236	5159	38395
1985-86	30168	14616	44784	39881	1902	41783
1986-87	30480	15476	45956	42761	556	43317
1987-88	30357	17734	48091	44728	739	45467
1988-89	32040	17815	49855	45699	4200	49899
1989-90	34087	19490	53577	48690	3971	52661
1990-91	33021	20699	53720	48562	6012	54574
1991-92	30346	23994	54340	48349	6509	54858
1992-93	26950	29247	56197	50359	7564	57923
1993-94	27026	30822	57848	51084	8042	59126
1994-95	32239	27349	59588	52927	10697	63624
1995-96	35168R	27342	62510R	55081	16900	71981
1996-97	32900R	33906	66806R	59005	17103	76108
1997-98	33858R	34494	68352R	61308	16580R	77888R
1998-99	32723R	39808	72531R	64544	17379	81923
1999-2000P	32005	44989	76994	79411	12168	91579

Source : Ministry of Petroleum & Natural Gas.

P - Provisional **R** - Revised

TABLE 4.2.18 : GROSS AND NET PRODUCTION & UTILISATION OF NATURAL GAS IN INDIA

(Million cubic metre)

Year	Gross production	Re-injected	Flared	Net production	Utilisation
1970-71	1445	36	762	647	647
1971-72	1535	49	768	718	718
1972-73	1565	141	653	771	771
1973-74	1713	115	836	762	762
1974-75	2041	139	951	951	951
1975-76	2368	162	1082	1124	1124
1976-77	2428	190	857	1381	1381
1977-78	2839	184	1191	1464	1464
1978-79	2812	148	953	1711	1711
1979-80	2767	127	964	1676	1676
1980-81	2358	67	769	1522	1522
1981-82	3851	110	1519	2222	2222
1982-83	4936	91	1888	2957	2957
1983-84	5961	45	2517	3399	3399
1984-85	7241	48	3052	4141	4141
1985-86	8134	66	3118	4950	4950
1986-87	9853	63	2718	7072	7072
1987-88	11467	54	3445	7968	7968
1988-89	13217	84	3883	9250	9250
1989-90	16988	96	5720	11172	11172
1990-91	17998	102	5130	12766	12766
1991-92	18645	132	4072	14441	14441
1992-93	18060	90	1854	16116	16116
1993-94	18335	71	1924	16340	16340
1994-95	19381R	23	2020R	17338R	17338R
1995-96	22639R	17	1420R	21202R	21202R
1996-97	23256	—	1760R	21495R	21495R
1997-98	26401R	—	1879R	24522R	24522R
1998-99	27428	—	1712	25716	25716
1999-2000P	28434	—	1562	26872	26872

Source : Ministry of Petrolium & Natural Gas.

P - Provisional R - Revised

TABLE 4.2.19 : INDUSTRY-WISE OFF-TAKE OF NATURAL GAS IN INDIA

(Million cubic metre)

Year	Energy purposes				Non-energy purposes		Total
	Power generation	Industrial fuel	Tea plantation	Others *	Fertilizer industry	Others @	
1970-71	261	116	15	68	187	—	647
1971-72	313	129	19	61	196	—	718
1972-73	339	148	20	63	201	—	771
1973-74	323	157	22	81	179	—	762
1974-75	354	164	29	86	318	—	951
1975-76	366	143	33	117	463	2	1124
1976-77	344	155	38	157	663	24	1381
1977-78	372	165	39	184	673	31	1464
1978-79	560	175	43	189	721	23	1711
1979-80	514	156	39	187	755	25	1676
1980-81	492	163	45	190	611	21	1522
1981-82	612	166	47	379	991	27	2222
1982-83	1025	185	51	513	1155	28	2957
1983-84	1209	230	56	588	1283	33	3399
1984-85	1454	250	62	739	1603	33	4141
1985-86	1299	223	78	816	2500	34	4950
1986-87	2041	257	93	1320	3335	26	7072
1987-88	2721	281	99	1347	3490	30	7968
1988-89	1823	526	87	1371	5334	109	9250
1989-90	214	695	78	1567	6578	114	11172
1990-91	3634	827	89	1825	5612	779	12766
1991-92	4774	766	108	2237	5509	1047	14441
1992-93	4967	1450	105	2103	6672	819	16116
1993-94	4785	1794	121	2466	6499	675	16340
1994-95	5229	1927	134	2420	6936	693	17339
1995-96 $	6836	2301	111	767	7602	474	18091
1996-97 $	6935	2631	130	802	7625	509	18632
1997-98 $	8114	3106	117	775	8752	649	21513
1998-99 $	8714	3005	147	1104	8869	650	22489
1999-2000P	9143	2502	147	1157	8917	1940	23806

Source : Ministry of Petroleum & Natural Gas.

P - Provisional

* Includes domestic fuel, captive use & LPG shrinkage.

@ Includes petro-chemicals.

$ Excludes off-takes of Natural Gas by ONGC.

TABLE 4.2.20 : BIOMASS ENERGY IN INDUSTRY

Country	Year	Total Industrial Energy Use	Wood Fuel		All Biomass	
			Energy (Tg)	Share (%)	Energy (Tg)	Share (%)
Bangladesh	1994	178000	28500	15.9	114900	64.2
Cambodia	1995	533	383	71.9	383	71.5
India	1996	4656003	375000	8.1	1094878	23.5
Malaysia	1993	1297	293	22.6	293	22.6
Nepal	1997	15951	3684	23.1	3935	24.7
Pakistan	1994	422280	(N.A.)	(N.A.)	92318	21.9
Sri Lanka	1996	51163	21773	42.6	26826	52.4
The philippines	1995	279211	38220	13.7	77533	27.8
Thailand	1997	700367	42789	6.1	194853	27.8
Vietnam	1995	219427	43500	19.8	87250	39.8

Source : Teri Energy Data Directory Yearbook, 2000-2001
N.A. : Not Available

TABLE 4.2.21 : BIOMASS POWER POTENTIAL

(MW)

Source	Potential
From surplus biomass	16000
From bagasse-based cogeneration in the existing suger mills	3500
Total	19500

Source : Teri Energy Data Directory Yearbook, 2000-2001

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TABLE 4.2.22 : THE STATUS OF BIOMASS PROJECTS

Project Status	Biomass Power		Cogeneration		Total	
	MW	Nos	MW	Nos	MW	Nos
Commissioned	39	10	183	30	222	40
Under implimentation	61.5	15	218.71	28	280.21	43

Source : Teri Energy Data Directory Yearbook, 2000-2001

TABLE 4.2.23 : STATEWISE AND YEARWISE COMPOSITION OF COMMISSIONED BIOMASS POWER PROJECTS

State	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000
Andhra Pradesh	-	-	-	-	1	-	10	1
Gujarat	-	-	-	-	-	-	0.5	-
Haryana	4	-	-	-	-	-	-	-
Karnataka	-	-	-	-	1	-	10	26
Maharashtra	1.5	-	1.5	4.5	1.5	-	-	-
Madhya Pradesh	-	-	-	-	-	-	5	-
Punjab	-	10	-	-	-	-	-	-
Tamil Nadu	3	3	-	19	25.5	33.5	10	-
Uttar Pradesh	-	-	4	6.5	-	8	8	24
Total	8.5	13	5.5	30	29	41.5	43.5	51

Source : Teri Energy Data Directory Yearbook, 2000-2001

TABLE 4.2.24 : INSTALLATION OF SOLAR PHOTOVOLTAIC SYSTEM IN DIFFERENT STATES/UT'S AS ON 31ST DECEMBER 1996

State / UT's	Lighting			Power Plants $(KW)_p$	Water Pumps
	Solar Lantern	Home Lighting System	Street Lighting System		
State					
Andhra Pradesh	5963	730	2932	18	345
Arunachal Pradesh	1518	52	720	8	-
Assam	175	700	98	1	45
Bihar	5800	6	619	0	86
Gujarat	3663	370	1564	14	16
Goa	-	31	38	2	14
Haryana	5018	6	577	24	16
Himachal Pradesh	6000	934	304	-	1
Jammu & Kashmir	2625	1051	889	-	15
Karnataka	300	-	441	-	93
Kerala	9810	965	513	5	240
Madhya Pradesh	1348	100	5427	9	11
Maharashtra	3792	72	2941	6	102
Manipur	767	-	351	5	1
Meghalaya	2055	230	588	31	-
Mizoram	-	-	-	-	-
Nagaland	-	8	271	6	-
Orissa	1846	252	2036	34	1
Punjab	682	-	60	2	77
Rajasthan	722	-	5545	114	121
Sikkim	196	31	93	-	-
Tamil Nadu	889	50	1940	26	424
Tripura	-	-	-	-	-
Uttar Pradesh	28250	35585	470	419	62
West Bengal	2102	1282	952	42	42
Union Territory					
Andaman and Nicobar Islands	234	390	315	129	5
Chandigarh	-	-	-	-	7
Dadra and Nagar Haveli	-	-	-	-	1
Daman and Diu	-	-	-	-	-
Delhi	4508	-	371	5	33
Lakshadweep	442	-	514	25	-
Pondicherry	215	-	-	-	14
Misc.(through agencies)	-	-	-	-	-
Total	88920	42845	30569	925	1772

Source : Teri Energy Data Directory Yearbook, 2000-2001

TABLE 4.2.25 : WIND POWER INSTALLED CAPACITY AS ON 30-06-2000

(MW)

State	Demonstration Projects	Commercial Projects	Total Capacity
Andhra Pradesh	3.5	84.99	88.04
Gujarat	17.35	149.57	166.91
Karnataka	2.58	34.65	37.23
Kerala	2.02	-	2.02
Madhya Pradesh	0.59	22	22.59
Maharashtra	6.4	75.9	82.3
Rajasthan	4.25	-	4.25
Tamil Nadu	19.36	751.38	770.74
Others	1.57	-	1.57
Total	57.62	1118.49	1175.65

Source : Teri Energy Data Directory Yearbook, 2000-2001

TABLE 4.2.26 : ALL INDIA POTENTIAL AVAILABILITY OF AGRICULTURE BASED BIOMASS

(Million Tonne)

Biomas	1980-81	1985-86	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96
Rice husk	26.8	31.9	37.1	37.3	36.5	40.2	40.9	39.8
Wheat straw	48.4	62.7	73.5	74.3	76.3	79.6	87.5	83.3
Maize cobs	2.1	2	2.7	2.4	3	2.9	2.7	2.8
Pearl millet straw	8.9	6.1	11.4	7.8	14.8	8.3	12	9
Sugarcane bagasse	51.4	56.9	80.4	84.7	76	75.8	90.9	93.4
Coconut shell	0.8	0.9	1.3	1.4	1.5	1.6	1.8	1.9
Coconut fibre	0.9	1.1	1.6	1.7	1.9	2	2.2	2.3
Coconut pith	1.4	1.7	2.4	2.5	2.8	2.9	3.3	3.4
Groundnut shell	1.7	1.7	2.5	2.4	2.9	2.6	2.7	2.6
Cotton stalks	23.5	22.6	22.3	23	22.6	22	23.7	27.3
Jute sticks	3.9	4.5	3.1	3.3	2.8	2.7	2.7	2.7

Source : Teri Energy Data Directory Yearbook, 2000-2001

TABLE 4.2.27 : AVERAGE ANNUAL CONSUMPTION OF FUELS BEFORE AND AFTER ADOPTION OF AN IMPROVED CHULLAH

Fuel	Annual Consumption		Quantity of Fuel Saved per Year
	Before Adoption	After Adoption	
Dung cake (kg)	860	609	251
Fire Wood (kg)	633	530	103
Twigs(kg)	543	530	13
Crops Wastes(kg)	276	271	5
Kerosene Oil(Ltr.)	8	5	3

Source : Teri Energy Data Directory Yearbook, 2000-2001

TABLE 4.2.28 : NATIONAL PROGRAMME ON IMPROVED CHULLAHS

(Number)

State / UT / Agency	Annual Target	Achievements (April—December 1998)
State		
Andhra Pradesh	100000	87443
Arunachal Pradesh	2500	-
Assam	12000	166
Bihar	40000	975
Gujarat	100000	28515
Goa	5000	1199
Haryana	55000	4876
Himachal Pradesh	1000	2295
Jammu & Kashmir	27500	30700
Karnataka	65000	9315
Kerala	100000	14551
Madhya Pradesh	250000	106
Maharashtra	140000	4619
Manipur	5000	1283
Meghalaya	10000	-
Mizoram	10000	502
Nagaland	10000	
Orissa	150000	77754
Punjab	75000	5000
Rajasthan	80000	18824
Sikkim	5000	1531
Tamil Nadu	60000	28647
Tripura	5000	969
Uttar Pradesh	250000	37656
West Bengal	275000	205505
Union Territory		
Andaman and Nicobar Islands	1200	618
Dadar and Nagar Haveli	1000	-
Delhi	5000	-
Lakshadweep	300	70
Pondicherry	4500	1600
Agency		
Khadi and Village Industries Commission,Mumbai	500000	250000
National Dairy Development Board	15000	6576
All India Women's Conference	40000	4551
Total	2400000	825846

Source : Teri Energy Data Directory Yearbook, 2000-2001

TABLE 4.2.29 : DISTRIBUTION OF FAMILY-TYPE BIOGAS PLANTS (NUMBER OF INSTALLATIONS)

State/UT	Total Esti. Potential	As on 31st March 1990	Additions							Total as on 31-12-96	Additions 1997-98
			1990-91	1991-92	1992-93	1993-94[a]	1994-95[a]	1995-96[a]	1996-97[a]		
State											
Andhra Pradesh	1065600	89327	8578	13777	14269	10291	9453	20632	6083	172410	18929
Arunachal Pradesh	7500	24	28	37	—	7	11	15	17	139	65
Assam	307700	8557	1191	987	810	199	381	355	150	12629	138
Bihar	939900	58553	4313	5397	3502	898	662	892	282	74499	641
Goa	8000	1448	216	203	157	69	48	35	36	2212	242
Gujarat	554000	92908	26537	33086	35551	17858	8298	19308	4237	237513	12061
Haryana	300000	18129	1948	1997	2028	1001	1011	1773	1009	28896	1300
Himachal Pradesh	125600	20822	3668	3510	3401	1316	423	1231	500	34871	1142
Jammu & Kashmir	128500	708	185	62	40	4	19	20	30	1068	—
Karnataka	680000	65968	6586	8600	15763	4306	9721	16721	7763	135428	12465
Kerala	150500	23471	3700	4436	2882	663	664	1250	308	37374	2765
Madhya Pradesh	1491200	37332	3637	4135	8035	6773	5004	18220	3325	86461	15269
Maharashtra	897000	370662	50384	51085	28465	10590	6577	12362	5154	535279	61671
Manipur	38700	339	77	116	150	77	50	142	87	1038	271
Meghalaya	24000	167	52	50	60	—	—	—	—	329	—
Mizoram	2200	591	120	78	120	56	55	82	76	1178	147
Nagaland	6700	124	—	—	—	—	20	182	75	401	121
Orissa	605500	48407	13022	8386	12521	6182	4806	12024	808	106156	7164
Punjab	411600	14802	2393	2197	2144	1702	2052	3464	2481	31235	5524
Rajasthan	915300	34864	3518	4169	3139	2421	2502	4047	644	55304	1526
Sikkim	7300	364	175	275	214	122	104	224	144	1622	174
Tamil Nadu	615800	127096	9983	9184	8112	5250	5167	4029	784	169605	1084
Tripura	28500	114	50	110	65	4	3151	51	31	3576	72
Uttar Pradesh	2021000	180806	17063	12414	10447	4330	—	10616	5720	241396	8463
West Bengal	695000	40474	8702	7121	5942	3629	1	6620	4224	76713	10974
Union Territory											
Andaman and Nicobar Islands	2200	98	—	—	10	—	—	5	4	117	5
Chandigarh	1400	77	1	4	—	—	—	5	—	87	—
Dadra & N. H.	2000	133	10	6	5	—	—	3	—	157	—
Daman and Diu	100	—	—	—	—	1	—	—	—	1	—
Delhi	12900	578	22	17	4	—	—	3	—	624	3360
Lakshadweep	—	—	—	—	—	—	—	—	—	—	—
Pondicherry	4300	447	25	18	25	2	—	—	—	517	—
Others	—	—	—	—	30242	11226	12478	37264	12884	104094	—
Total	2050000	1237390	166184	171457	188103	88977	72658	171575	56856	2152929	165573

Source : Teri Energy Data Directory Yearbook, 2000-2001

a : Figures correspond to intallations from April to December

b : These figures are lower estimates of the actual installations.

TABLE 4.3.1 : NUMBER OF REGISTERED FACTORIES BY MANUFACTURING INDUSTRIES

Year	Manufacturing	Electricity Gas and Water	Repair Services and Cold Storage	All Activities
1987-88	98379	458	3759	102596
1988-89	99724	481	3872	104077
1989-90	103373	493	4126	107992
1990-91	105511	518	4150	110179
1991-92	107454	505	4327	112286
1992-93	113890	961	4643	119494
1993-94	116227	542	4825	121594
1994-95	117564	554	4892	123010
1995-96	125281	4013	5277	134571
1996-97	125166	4160	5230	134556
1997-98	126272	3856	5423	135551

Source : ASI Summary Results

TABLE 4.3.2 : SUMMARY STATUS OF POLLUTION CONTROL IN 17 CATEGORIES OF INDUSTRIES

(as on 31-12-1999)

S. No.	Category	Total No. of Units	Status (No of Units)		
			Closed	C #	Defaulter ##
1	Aluminium	7	1	6	0
2	Caustic Soda	25	0	25	0
3	Cement	116	8	104	4
4	Copper	2	0	0	2
5	Distillery	177	27	123	27
6	Dyes and Dying Industries	64	6	56	2
7	Fertilizer	110	10	97	3
8	Iron and Steel	8	0	2	6
9	Leather	70	11	59	0
10	Pesticide	71	6	63	2
11	Petrochemicals	49	0	49	0
12	Pharmaceuticals	251	26	224	1
13	Pulp and Paper	96	19	71	6
14	Refinery	12	0	12	0
15	Sugar	392	37	317	38
16	TPP	97	2	72	23
17	Zinc	4	0	4	0
	Total	1551	153	1284	114

Source: Ministry of Environment and Forests, Annual Report 1999-2000.

\# : Having adequate facilities to comply with the standards.

\## : Not having adequate facilities to comply with the standards.

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 (SO_2, NO_X, 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.

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CHART 9 : SUMMARY STATUS OF POLLUTION IN 17 HIGHLY POLLUTED INDUSTRIES

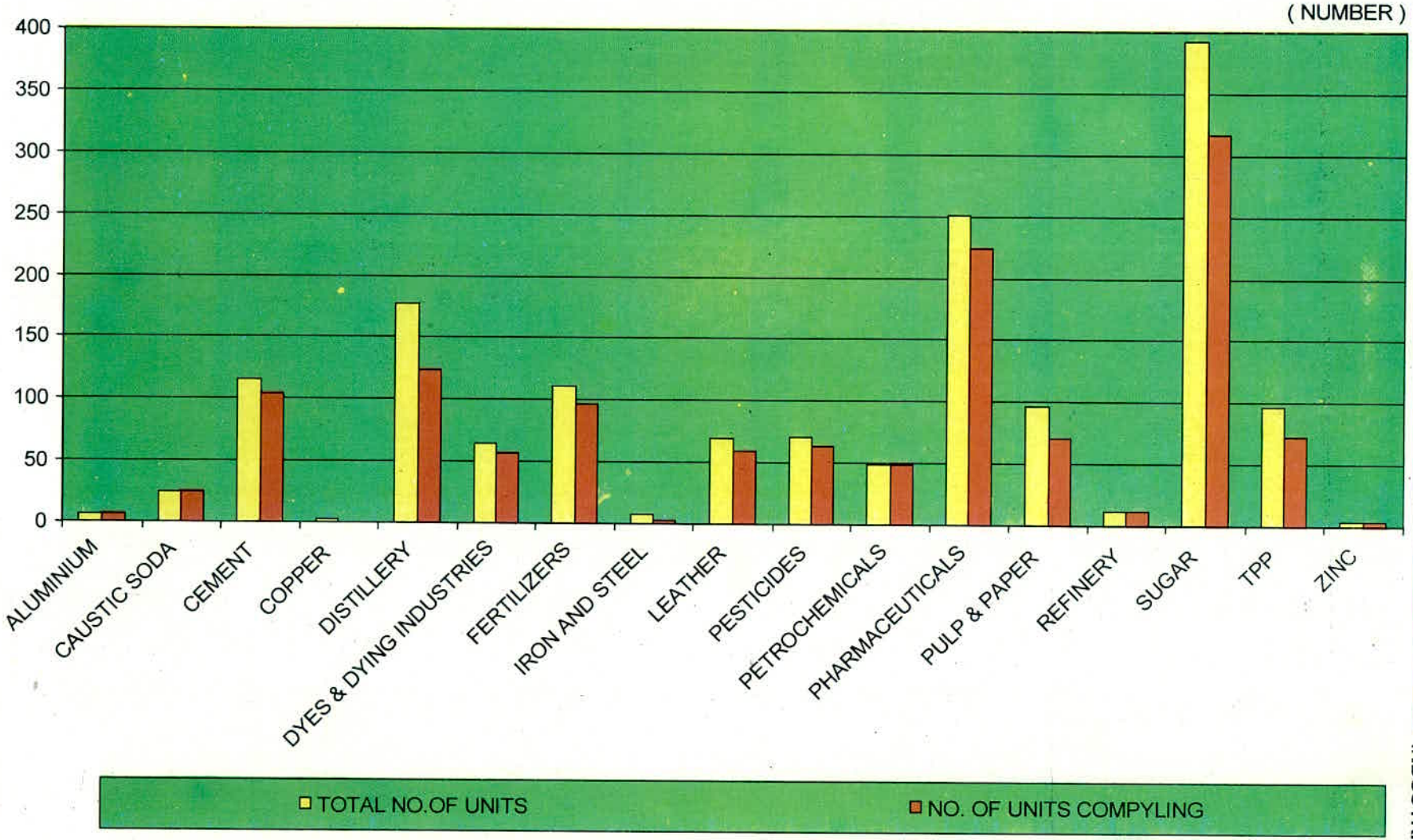


TABLE 4.3.3 : STATE-WISE SUMMARY STATUS OF THE POLLUTION CONTROL IN 17 CATEGORIES OF INDUSTRIES

(as on 31-12-1999)

Sl. No.	State/UT	Total No. of units	Status (No. of units)		
			Closed	C#	Defaulters ##
1	Andhra Pradesh	173	29	142	2
2	Arunchal Pradesh	0	0	0	0
3	Assam	15	2	11	2
4	Bihar	62	17	35	10
5	Goa	6	0	6	0
6	Gujarat	177	4	167	6
7	Haryana	43	3	34	6
8	Himachal Pradesh	9	0	9	0
9	Jammu & Kashmir	8	3	1	4
10	Karnataka	85	9	68	8
11	Kerala	28	6	20	2
12	Madhya Pradesh	78	6	59	13
13	Maharashtra	335	22	296	17
14	Manipur	0	0	0	0
15	Meghalaya	1	0	0	1
16	Mizoram	0	0	0	0
17	Nagaland	0	0	0	0
18	Orissa	23	1	15	7
19	Punjab	45	5	33	7
20	Rajasthan	49	6	42	1
21	Sikkim	1	0	0	1
22	Tamil Nadu	119	2	116	1
23	Tripura	0	0	0	0
24	Uttar Pradesh	224	21	189	14
25	West Bengal	58	16	33	9
26	UT-Andaman & Nicobar	0	0	0	0
27	UT-Chandigarh	1	0	1	0
28	UT-Daman & Diu, Dadra & Nagar Haveli	0	0	0	0
29	UT-Delhi	5	0	3	2
30	UT-Lakshadweep	0	0	0	0
31	UT-Pondicherry	6	1	4	1
	Total	**1551**	**153**	**1284**	**114**

Source : Ministry of Environment & Forests, Annual Report 1999-2000

\# Having adequate facilities to comply with the standards

\## Not having adequate facilities to comply with the standards

TABLE 4.3.4 : SUMMARY STATUS OF POLLUTION CONTROL IN GROSSLY POLLUTING INDUSTRIES DISCHARGING THEIR EFFLUENTS INTO RIVERS AND LAKES

(as on 30-9-1999)

S. No.	Name of the State/UT	No. of defaulters as on August'97 issuance of directions	No. of complying industries after closed	No. of industries	No. of defaulters
1	Andhra Pradesh	60	20	10	30
2	Assam	7	0	4	3
3	Bihar	14	10	4	0
4	Gujarat	17	13	3	1
5	Haryana	21	7	5	9
6	Karnataka	20	14	0	6
7	Kerala	36	32	4	0
8	Madhya Pradesh	2	0	0	2
9	Maharashtra	6	1	3	2
10	Orissa	9	3	1	5
11	Pondicherry	4	1	0	3
12	Punjab	18	4	2	12
13	Tamil Nadu	366	242	44	80
14	Uttar Pradesh	241	120	43	78
15	West Bengal	30	9	7	14
	Total	**851**	**476**	**130**	**245**

Source : Ministry of Environment & Forests, Annual Report 1999-2000.

TABLE 4.3.5 : MAXIMUM PERMISSIBLE LIMITS FOR INDUSTRIAL EFFLUENT DISCHARGES

(mg/litre)

Parameter	Into inland surface waters Indian Standards 2490 (1974)	Into public sewers Indian Standards 3306 (1974)	Onland for irrigation Indian Standards 3307 (1974)
pH	5.9-9	5.5-9.0	5.5-9.0
Biological oxygen demand (for 5 days at 20°C)	30	350	100
Chemical oxygen demand	250	-	-
Suspended solids	100	600	200
Total dissolved solids (inorganic)	2100	2100	2100
Temperature (°C)	40	45	-
Oil and grease	10	20	10
Phenolic Compounds	1	5	-
Cyanides	0.2	2	0.2
Sulphides	2	-	-
Fluorides	2	15	-
Total residual chlorine	1	-	-
Pestisides	-	-	-
Arsenic	0.2	0.2	0.2
Cadmium	2	1	-
Chromium (hexavalent)	0.1	2	-
copper	3	3	-
Lead	0.1	1	-
Mercury	0.01	0.01	-
Nickel	3	3	-
Selenium	0.05	0.05	-
Zinc	5	15	-
Chlorides	1000	1000	600
Boron	2	2	2
Sulphates	1000	1000	1000
Sodium (%)	-	60	60
Ammoniacal nitrogen	50	50	-
Radioactive materials			
Alpha emitters (milli curie/millilitre)	10^{-7}	10^{-7}	10^{-8}
Beta emitters (μ curie/millilitre)	10^{-6}	10^{-6}	10^{-7}

Source : Teri Energy Data Directory Yearbook, 2000-2001

TABLE 4.3.6 : EFFLUENT STANDARDS FOR SUGAR INDUSTRY

Parameter	Permissible Limits (mg/litres)	
	Disposal on land	Disposal in surface water
Biological Oxygen Demand (5 days at 20°C)	100	30
Suspended Solids	100	30

Source : Teri Energy Data Directory Yearbook, 2000-2001

TABLE 4.3.7 : EFFLUENT STANDARDS FOR LARGE PULP AND PAPER INDUSTRIES

Capacity (Tonnes a year)	Parameter	Permissible Limits
Above 24,000	pH	7.0-8.5
	Biological Oxygen Demand at 20°C	30 mg/litre
	Chemical Oxygen Demand	350 mg/litre
	Suspended solids	50 mg/litre
	Total organic chloride	2.0 kg/tonne of paper produced
	Flow (total waste water discharge)	—
	Large pulp and paper[a]	200 m^3/tonne of paper produced
	Large rayon grade newsprint	150 m^3/tonne of paper produced

Source : Teri Energy Data Directory Yearbook, 2000-2001

a—The standards with respect to total waste water discharge for large pulp and paper mills established from 1992 will meet the standards of 100 m^3/tonne of paper produced

TABLE 4.3.8 : EFFLUENT STANDARDS FOR OIL REFINARIES

(mg/litre)

Parameter	Permissible Limit	Quantum (Kg/thousand tonnes of crude processed)
Oil and grease	10.0	7.00
Phenol	1.0	0.70
Sulphide	0.5	0.35
Biological Oxygen Demand (5 days at 20°C)	15.0	10.50
Suspended Solids	20.0	14.00
pH	—	6.00-8.50

Source : Teri Energy Data Directory Yearbook, 2000-2001

TABLE 4.3.9 : EFFLUENT STANDARDS FOR Al(ALUMINIUM) INDUSTRY

Plant	Parameters	Permissible Limits
Alumina Plant		
Raw material handling	Primary and secondary crusher particulate matter	150 mg/m^3
Precipitation area : calcination	Particulate matter	250 mg/m^3
	Carbon Mono-oxide	1 % maximum
	Stack Height[a]	
Smelter plant		
Green anode shop	Particulate matter	150 mg/m^3
Anode bake oven	Particulate matter	150 mg/m^3
	Total fluoride	0.3kg/tonne at Al
Potroom	Particulate matter	150 mg/m^3
	Total fluoride	
	Vertical stud soderberg	4.7 kg/tonne of Al produced
	Horizontal stud soderberg	6.0 kg/tonne of Al produced
	Prebacked side worked	2.5 kg/tonne of Al produced
	Prebacked centre worked	1.0 kg/tonne of Al produced
	Stack Height[a]	

Source : Teri Energy Data Directory Yearbook, 2000-2001

a $H = 14\ Q^{0.3}$, where Q is the emission rate of sulphur dioxide in Kg/h and H is the stack height in meters.

TABLE 4.3.10 : EFFLUENT STANDARDS FOR PETRO-CHEMICAL (BASIC & INTERMEDIATES) INDUSTRY

(mg/litre)

Parameter	Permissible Limit
pH	6.5-8.5
Biological Oxygen Demand (5 days at 20°C)[a]	50.0
Phenol[b]	5.0
Sulphide (as S)	2.0
Chemical Oxygen Demand	250.0
Cyanide (as CN)	0.2
Fluoride (as F)[c]	15.0
Total Suspended Solids	1000.0
Hexavalent Chromium	0.1
Total Chromium (as Cr)[d]	2.0

Source : Teri Energy Data Directory Yearbook, 2000-2001

a The state board may prescribe the biological oxygen demand value of 30 mg/l if the recepient system so demands.

b The limit for phenol shall be confirmed at the outlet of effluent treatment of phenol plant. However, at the final disposal point, the limit shall be less than 1 mg/l

c The limit for flurlde shall be confirmed at the outlet of the chrome removal unit. However at the disposal point, fluoride concentration shall be lower than 5 mg/l

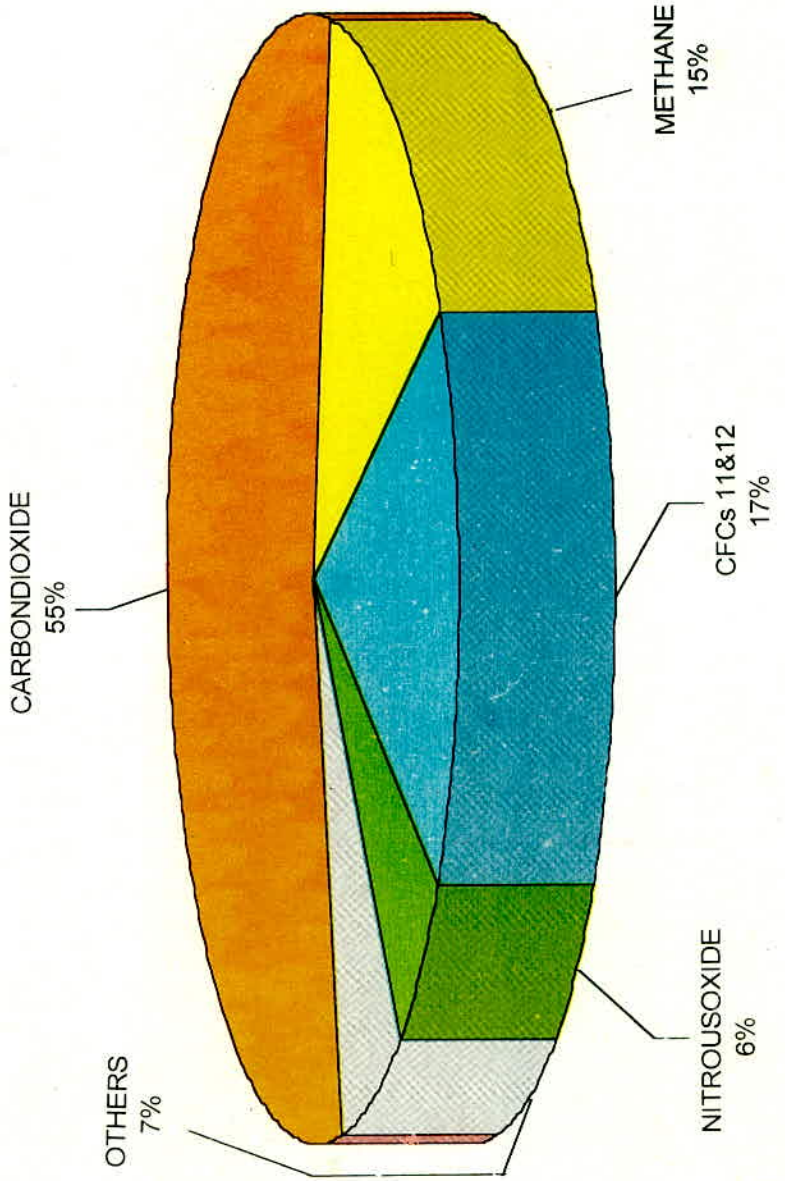
d The limits for total and hexavalent chromium shall be confirmed at the outlet of the chromate removal. This implies that in the final treated effluent total, and hexavalent chromium shall be lower than prescribed herein

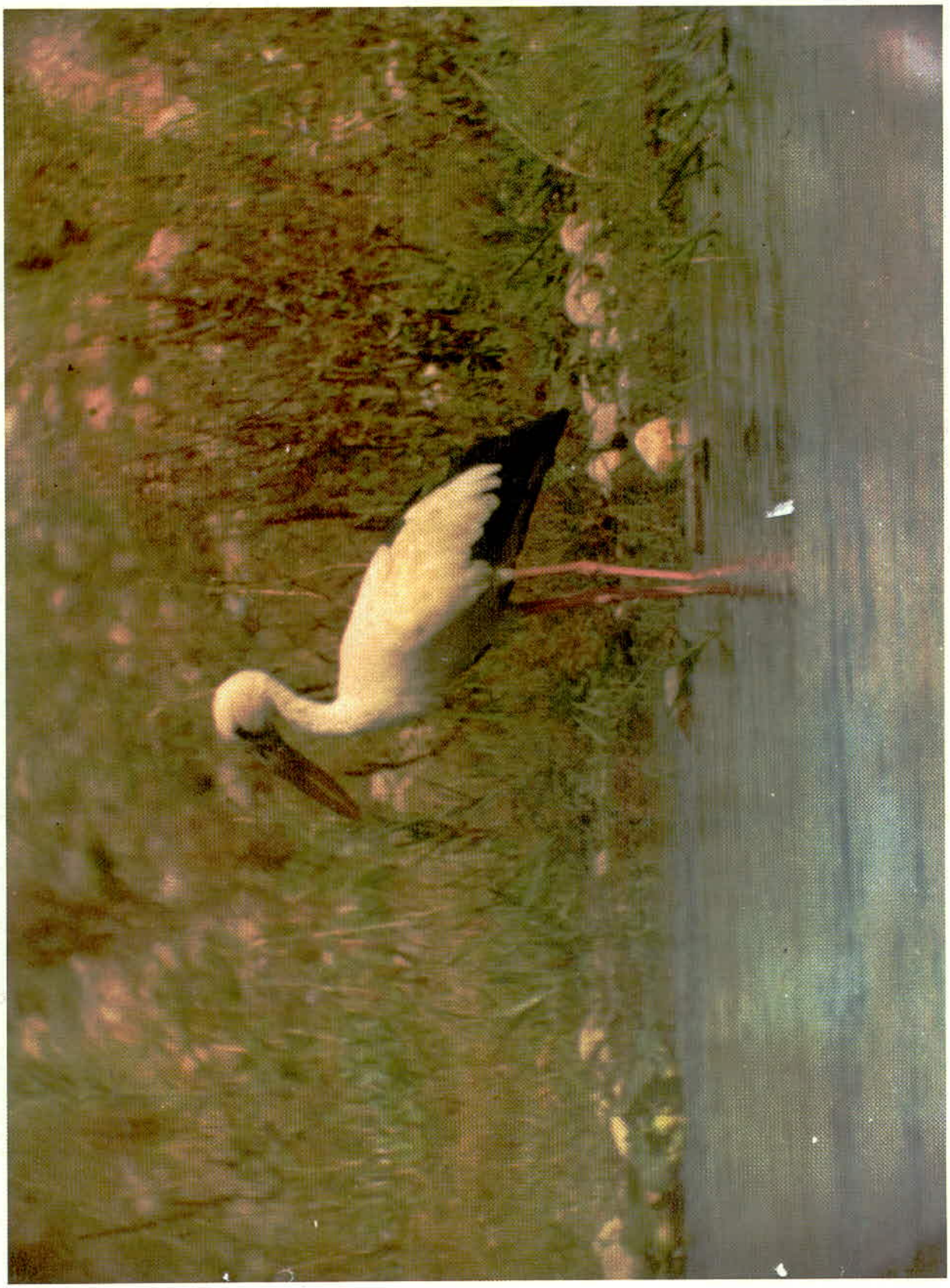
TABLE 4.4.1 : CONTRIBUTION OF GREEN HOUSE GASES TO ATMOSPHERE

Green Houses Gases	Contribution to atmosphere (%)
Carbondioxide	55
Methane	15
CFCs 11 & 12	17
Nitrousoxide	6
Others	7

Source : Central Pollution Control Board

CHART 10 : CONTRIBUTION OFGREEN HOUSE GASES TO ATMOSPHERE (%)





Openbill Stork at the bank of Asan Reservoir, Doon Valley

TABLE 4.4.2 : 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
Concentration in 1994	358 ppmv	1720 ppbv	312 ppbv	268 pptv	110 pptv	72 pptv
Concentration in 1997$	366.7 ppmv	1800 ppbv	312 ppbv	264 pptv	126 pptv	
Concentration Change per year $	1.8 ppmv/yr	13.8 ppmv/yr	0.6 ppmv/yr	-0.6 ppmv/yr	5.1 ppmv/yr	1.2 ppmv/yr
Rate of Concent-ration change per year$	0.5%	0.8%	0.2%	-0.2%	5%	2%
Atmospheric life-time (years)	(50-200)*	12#	120	50	12	50000
Global warming potential (100 year time horizon)$	1	21	310	4000	1700	6500

Source : TEDDY 1999/2000, Tata Energy Research Institute

* 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

$ Compiled by TERI based on data from Carbon-di-Oxide Information Analysis Centre(website : http:// cdiac.esd.ornl.gov), values of Concentration in 1997 are from the advanced global atmospheric gases experiment, Mace Head Ireland Monitoring site.

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

S. No.	CFC/HCFC	ODP	GWP lifetime (years)	Atmospheric
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 wave terrestrial radiation emitted by the earth's surface is partially absorbed and then reemitted 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.

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TABLE 4.4.4 : 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 4.5.1 : 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 : Central Pollution Control Board

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 ;

\+ 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 4.5.2 : AVERAGE NOISE LEVELS IN VARIOUS METROPOLITAN CITIES

(dB[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 : Ministry of Environment & 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 4.5.3 : EFFECTS OF NOISE POLLUTION ON HUMAN HEALTH

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

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 is 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, the saline land in part of the Rann of Kutch in Gujarat, and the weed infected and ravine land in Madhya Pradesh. Recently the area under non-agricultural uses has increased due to increases in developmental activities e.g. housing, transport system, 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 1970/71 , the net area sown has remained almost the same at around 142 mha level. The data shows that land use in the country, over the last five decades, has undergone drastic change. Land under agriculture has almost doubled, forest cover has dwindled to less than half, large tracts of fertile agriculture and forest land have been diverted for urbanization and settlements. Deforestation contributes to loss of precious top soil which amounts to about 35 per cent of the global sediment load going to oceans even though water flowing through our rivers is only about five per cent of the flow of rivers in the world.

LAND DEGRADATION

Land is degraded when it suffers a loss of intrinsic qualities or a decline in its capabilities, loss in its productive capacity. Land degradation may be due to natural causes or human causes or it may be due to combination of both. Soil erosion is the major cause of land degradation.

SOIL EROSION

Soil is the non-renewable natural resource, which supports life on earth. It is estimated that one-sixth of the world's soils have already been degraded by water and wind erosion. This has two important consequences: the reduced ability of society to produce sufficient food due to loss of quality and depth of soils; and the off-site pollution effects associated with erosion. These include siltation of dams, pollution of watercourses by agricultural chemicals and damage to property by soil-laden run-off. On-site issues of declining soil quality tend to be spatially dispersed occurring on many different soil types whereas off-site pollution issues tend to be locally concentrated.

Soil erosion problems are not confined to the Developing World. In the last two decades there has been a growing appreciation of the threat to European soils as a result of intensification of agriculture, overgrazing and climate change. The threat is most apparent in the Mediterranean region where the term "desertification" has been used to describe a series of inter-related changes which include soil erosion. The EU-funded MEDALUS (Mediterranean Desertification and Land Use) project is currently addressing these latter issues for much of southern Europe.

In India 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 grass lands, 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 cause expansion of deserts, dust, storms, whirlwinds and destruction of crops, while moving sand covers the land and makes it sterile. Excessive soil erosion with consequent high rate of sedimentation in the reservoirs and decreased fertility have become serious environmental problems with disastrous economic consequences. Of the 16 rivers of world which experience severe erosion and carry heavy sediment load, 3 rivers, namely Ganges, Brahmaputra and Kosy occupy the 2nd, 3rd and 12th position respectively.

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, habitations 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 leads to atmospheric pollution. Escape of fertilizer-N as ammonia gas is called ammonia volatilization. The presence of ammonia and sulphur dioxide may lead to acid rains which ultimately degrade the soil. Atmospheric ammonia contaminate water bodies, impairs visibility and causes corrosion. Nitrous oxide also contributes to global warming.

MINING

The activity of mining and quarrying covers underground and surface mines, quarries and wells and includes extraction of minerals and also all the supplemental activities such as dressing and benefaction of ores, crushing, screening, washing, cleaning, grading, milling floatation, melting floatation and other preparations carried out at the mine site which are needed to render the material marketable.

The mining activities in the country are governed by the Mineral Conservation Development Rules (MCDR) 1988. Every license holder of 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 of 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 Indian Bureau of Mines collects the statistics on all these aspects under the above rules.

TABLE 5.1.1 : LAND USE CLASSIFICATION IN INDIA

(Mha)

Classification	1950-51	1960-61	1970-71	1980-81	1990-91	1991-92 P	1992-93 P	1993-94 P	1994-95 P	1995-96	1996-97
I. Geographical area	328.73	328.73	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	304.84	304.86	304.83	304.88	304.88
1. Forests	40.48	54.05	63.91	67.47	67.80	67.87	67.98	68.31	68.60	68.82	68.75
2. Not available for cultivation (a+b)	47.52	50.75	44.64	39.62	40.48	40.74	40.91	40.92	41.28	41.37	41.54
(a) Non Agricultural Uses	9.36	14.84	16.48	19.66	21.09	21.47	21.87	22.21	22.56	22.36	22.45
(b) Barren and un culturable land	38.16	35.91	28.16	19.96	19.39	19.27	19.04	18.71	18.46	19.01	19.09
3. Other uncultivated land [excluding fallow and(a+b+c)]	49.45	37.64	35.06	32.31	30.22	30.05	29.40	29.08	29.07	28.64	28.55
(a) Permanent Pastures and other grazing land	6.68	13.97	13.26	11.97	11.40	11.3	11.07	10.96	11.03	11.06	11.04
(b) Land under Miscellaneous tree crops and groves not included in net area sown	19.83	4.46	4.30	3.60	3.82	3.76	3.76	3.71	3.73	3.48	3.57
(c) Culturable Wasteland	22.94	19.21	17.50	16.74	15.00	14.99	14.57	14.41	14.26	14.10	13.94
4. Fallow Land (a+b)	28.12	22.82	19.88	24.75	23.36	24.61	23.83	24.21	23.30	23.85	23.27
(a) Fallow land other than current Fallows	17.44	11.18	8.76	9.92	9.66	9.94	9.68	9.83	9.97	10.02	9.89
(b) Current Fallows	10.68	11.64	11.12	14.83	13.70	14.67	14.15	14.38	13.25	13.83	13.33
5. Net area sown(6-7)	118.75	133.20	140.27	140.00	143.00	141.63	142.72	142.34	142.96	142.20	142.82
6. Gross cropped area	131.89	152.77	165.79	172.63	185.74	182.24	185.70	186.58	188.05	187.47	189.54
7. Area sown more than once	13.14	19.57	25.52	32.63	42.74	40.61	42.98	44.24	45.09	45.27	46.72
8. Cropping intensity*	111.10	114.70	118.20	123.30	129.90	128.70	130.10	131.08	131.50	131.84	131.71
III. Net irrigated area	20.85	24.66	31.10	38.72	47.78	49.87	50.30	51.34	53.00	53.40	55.14
IV. Gross irrigated area	22.56	27.98	38.19	49.78	62.47	65.68	66.76	68.26	70.65	71.35	73.28

Source: 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 22 mha are occupied for non-agricultural uses (housing, industry and others), 19 mha are snow bound and remote leaving only 264 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 1996-97, indicating that the private efforts have peaked and the intervention of the Government is required for further land reclamation.

CHART 11 : LAND USE CLASSIFICATION IN INDIA

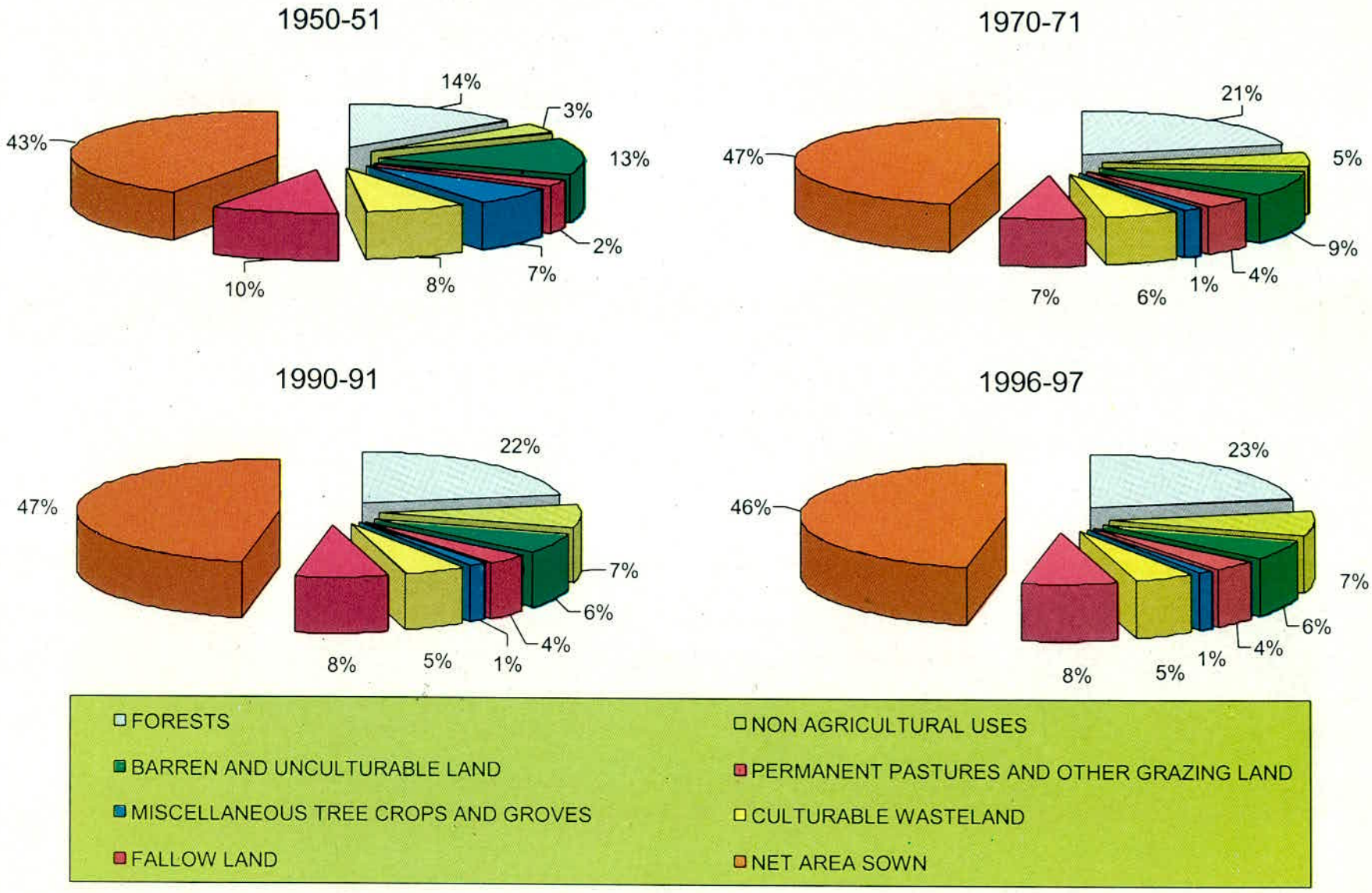

TABLE 5.1.2 : SELECTED CATEGORIES OF LAND USE CLASSIFICATION

(Mha)

Years	Net sown area	Gross sown area	Net irrigated area	Gross irrigated area
1950-51	118.75	131.89	20.85	22.56
1960-61	133.20	152.77	24.66	27.98
1970-71	140.27	165.79	31.10	38.19
1980-81	140.00	172.63	38.72	49.78
1985-86	140.90	178.46	41.86	54.28
1990-91	143.00	185.74	47.78	62.47
1991-92	141.63	182.24	49.87	65.68
1992-93	142.72	185.70	50.30	66.76
1993-94P	142.34	186.58	51.34	68.26
1994-95P	142.96	188.05	53.00	70.65
1995-96P	142.20	187.47	53.40	71.35
1996-97P	142.82	189.54	55.14	73.28

Source :Department of Agriculture & Cooperation, Ministry of Agriculture.

P :Provisional

The net area under irrigation has increased from 21 mha in 1950-51 to 55.14 mha in 1996-97. 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 siltation of riverbeds.

TABLE 5.1.3 : STATE-WISE INFORMATION ON PRIORITY WATERSHEDS OF RIVER VALLEY PROJECTS/FLOOD PRONE RIVERS CATCHMENTS

(Area in Lakh hectare)

S No.	State/UT	Total	Surveyed	Total SWS*	Very High		High		Total Priority	
					SWS	Area	SWS	Area	SWS	Area
1	Andaman & Nicobar	—	—	—	—	—	—	—	—	—
2	Andhra Pradesh	56.48	56.42975	1559 + 21 (P)	151	4.29	321	10.13	472	14.42
3	Arunachal Pradesh	0.00	—	—	—	—	—	—	—	0.00
4	Assam	1.53	1.52635	66 + 2 (P)	21 + 2 (P)	0.52	14	0.34	35 + 2 (P)	0.86
5	Bihar	83.60	83.59944	3033 + 12 (P)	454 + 1 (P)	11.08	655 + 8 (P)	16.16	1109 +9 (P)	27.24
6	Chandigarh	0.10	0.10437	11	6	0.04	—	—	6	0.04
7	Dadra & Nagar Haveli	0.10	0.10000	5	4	0.08	1	0.02	5	0.10
8	Daman & Diu	0.00	—	—	—	—	—	—	—	0.00
9	Delhi	1.06	1.06025	54	8	0.09	4	0.08	12	0.17
10	Goa	0.00	—	—	—	—	—	—	—	0.00
11	Gujarat	5.73	5.73476	225 + 4 (P)	41 + 1 (P)	0.79	58 + 1 (P)	1.37	99 + 2 (P)	2.15
12	Haryana	18.13	18.12850	624	66	1.58	55	1.49	121	3.07
13	Himachal Pradesh	28.96	28.96478	1719 + 2 (P)	497 + 2 (P)	8.85	404	6.97	901 + 2 (P)	15.82
14	Jammu & Kashmir	2.76	2.75560	338.2 (P)	36 + 2 (P)	0.69	25	0.48	61 + 2 (P)	1.16
15	Karnataka	95.68	95.68136	2990 + 66 (P)	248	8.38	549 + 2 (P)	11.69	797 + 2 (P)	20.07
16	Kerala	2.85	2.84749	105 + 10 (P)	24	0.45	28	1.10	52	1.55
17	Lakshadweep	0.00	—	—	—	—	—	—	—	0.00
18	Madhya Pradesh	287.67	261.97276	9297 + 50 (P)	1225 + 6 (P)	27.38	1654 + 11 (P)	41.04	2879 + 17 (P)	68.42
19	Maharashtra	201.71	197.05760	5131 + 37 (P)	400	15.90	757 + 2 (P)	29.39	1157 + 2 (P)	45.29
20	Manipur	0.00	—	—	—	—	—	—	—	0.00
21	Meghalaya	0.00	—	—	—	—	—	—	—	0.00
22	Mizoram	0.05	0.04735	2	2	0.05	—	—	2	0.05
23	Nagaland	0.00	—	—	—	—	—	—	—	0.00
24	Orissa	30.37	27.39206	997 + 41 (P)	134 + 5 (P)	3.20	204 + 5 (P)	5.48	338 + 10 (P)	8.68
25	Pondicherry	0.00	—	—	—	—	—	—	—	0.00
26	Punjab	10.32	10.32454	326	12	0.17	12	0.35	24	0.52
27	Rajasthan	51.49	35.48823	1441 + 4 (P)	199 + 1 (P)	4.45	243 + 1 (P)	6.41	442 + 2 (P)	10.86
28	Sikkim	9.68	4.09039	97	39	1.74	12	0.40	51	2.14
29	Tamil Nadu	5.48	5.47834	204	27	0.44	17	0.40	44	0.84
30	Tripura	0.45	0.45230	34	7	0.09	18	0.26	25	0.35
31	Uttar Pradesh	65.39	65.38760	2726	477	8.98	764	16.81	1241	25.79
32	West Bengal	19.73	19.73084	788	53	1.42	105	2.64	158	4.06
	Total	979.32	924.35466	31772 + 251 (P)	4131 + 20 (P)	100.65	5900+30 (P)	153.01	10031+50 (P)	253.65

Source : All India Soil and Land Use Survey

SWS : Sub Watershed (P): Partly

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

(Area in Lakh hectare)

S No.	State/UT	Catchment Area	Surveyed Area	Priority Area	Subwatershed area on which reports available
1	Andaman & Nicobar	—	—	—	—
2	Andhra Pradesh	56.48	56.43	14.42	7.24
3	Arunachal Pradesh	0.00	0.00	0.00	0.00
4	Assam	1.53	1.53	0.86	0.14
5	Bihar	83.60	83.60	27.24	10.76
6	Chandigarh	0.10	0.10	0.04	0.00
7	Dadra & Nagar Haveli	0.10	0.10	0.10	0.14
8	Daman & Diu	0.00	0.00	0.00	0.00
9	Delhi	1.06	1.06	0.17	0.00
10	Goa	0.00	0.00	0.00	0.00
11	Gujarat	5.73	5.73	2.15	1.61
12	Haryana	18.13	18.13	3.07	0.22
13	Himachal Pradesh	28.96	28.96	15.82	4.85
14	Jammu & Kashmir	2.76	2.76	1.16	0.16
15	Karnataka	95.68	95.68	20.07	11.92
16	Kerala	2.85	2.85	1.55	0.96
17	Lakshadweep	0.00	0.00	0.00	0.00
18	Madhya Pradesh	287.67	261.97	68.42	27.12
19	Maharashtra	201.71	197.06	45.29	14.35
20	Manipur	0.00	0.00	0.00	0.00
21	Meghalaya	0.00	0.00	0.00	0.00
22	Mizoram	0.05	0.05	0.05	0.00
23	Nagaland	0.00	0.00	0.00	0.00
24	Orissa	30.37	27.39	8.68	9.82
25	Pondicherry	0.00	0.00	0.00	0.00
26	Punjab	10.32	10.32	0.52	0.01
27	Rajasthan	51.49	35.49	10.86	4.66
28	Sikkim	9.68	4.09	2.14	0.99
29	Tamil Nadu	5.48	5.48	0.84	1.20
30	Tripura	0.45	0.45	0.35	0.04
31	Uttar Pradesh	65.39	65.39	25.79	3.85
32	West Bengal	19.73	19.73	4.06	7.38
	Total	979.32	924.35	253.65	107.43

Source: All India Soil and Land Use Survey

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. Potassic(K)	Lakh Tonnes	6.24	13.28	8.84	9.08	11.25	11.56	10.29
Total (I.+II.+III.)	Lakh Tonnes Kg./ha	55.16 31.83	125.46 67.49	121.55 65.33(E)	123.66 66.69(E)	135.64 73.12(E)	138.77 74.43(E)	143.08 76.75(E)
3. Consumption of Pesticides (Technical Grade Material)	Thousand Tonnes	45.00	75.00	70.79	63.65 (Achieve-ments)	61.36	61.26	56.11
4. Area under High Yielding Varieties	Million ha	43.08	64.98	65.40	66.99	70.93	72.11	NA
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
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

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

* : Provisional Ant :Anticipated (E) : Estimated

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

TABLE 5.2.2 : PERFORMANCE OF CROP PRODUCTION

(Million tonne)

Crops	Production						
	1991-92	1992-93	1993-94	1994-95	1996-97	1997-98	1998-99
Rice	74.68	72.86	80.30	81.81	81.73	82.54	86.00
Wheat	55.69	57.21	59.84	65.77	69.35	66.35	70.78
Coarse Cereals	25.99	36.59	30.82	29.88	34.11	30.40	31.46
Total Cereals	156.36	166.67	170.96	177.46	185.19	179.29	188.24
Total Pulses	12.02	12.82	13.30	14.04	14.25	12.97	14.80
Total Foodgrains	168.38	179.48	184.26	191.50	199.44	192.26	203.04
Sugarcane	254.00	228.03	229.66	275.54	277.56	279.54	295.73
Total Oilseeds	18.60	20.11	21.50	21.34	24.38	21.32	25.21
Cotton @	9.71	11.40	10.74	11.89	14.23	10.85	12.18
Jute & Mesta #	10.29	8.59	8.43	9.08	11.13	11.02	9.70
Non Foodgrains *	158.80	164.00	169.50	180.90	200.90	180.60	198.10
All Crops *	145.50	151.60	157.30	165.20	175.70	164.90	177.20

Source : Department of Agriculture & Cooperation, Ministry of Agriculture

@ : Production in million bales of 170 kgs. each

: Production in million bales of 180 kgs. each

* : Index number base : 1981-82 = 100

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 hectare)

Crops	1970-71	1980-81	1990-91	1994-95	1996-97	1997-98	1998-99
Rice	37.6	40.2	42.7	42.8	43.4	43.4	44.6
Wheat	18.2	22.3	24.2	25.8	25.9	26.7	27.4
Pulses	22.5	22.5	24.7	23	22.4	22.9	23.8
Foodgrains	124.3	126.7	127.8	123.9	123.6	123.8	125.4
Cotton	7.6	7.8	7.4	7.9	9.1	8.9	9.3
Jute & Mesta	1.1	1.3	1.0	0.9	1.1	1.1	1.0
Sugarcane	2.6	2.7	3.7	3.9	4.2	3.9	4.1
Tobacco	0.5	0.5	0.4	0.4	0.4	0.5	0.5
Oilseeds	16.6	17.6	24.1	25.3	26.34	26.12	26.71

Source : Department of Agriculture and Cooperation.

TABLE 5.2.4 : CONSUMPTION OF TECHNICAL GRADE PESTICIDES

(in Tonne)

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(A) : CAPACITY AND PRODUCTION IN THE CHEMICAL INDUSTRY IN INDIA DURING 1995-96 TO 1999-2000 (INSECTICIDES)

(In Thousand tonne)

S. No.	Products	1995-96		1996-97		1997-98		1998-99		1999-2000	
		Inst. Cap.	Production	Inst. Cap.	Production	Inst. Cap.	Production	Inst. Cap.	Production	Inst. Cap.	Production
Insecticides											
1	B.H.C.	37.0	25.0	37.0	17.6	37.0	0.0	37.0	0.0	—	—
2	D.D.T.	9.1	6.0	6.3	4.1	6.3	4.2	6.3	3.4	6.3	
3	Malathion	7.6	4.2	7.6	4.0	9.9	4.7	9.9	5.2	9.5	5.9
4	Parathion (Methyle)	4.5	2.0	4.5	2.3	4.5	2.3	4.5	2.3	4.0	1.9
5	Fenitrothion	—	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	—
6	Dimethoate	3.6	1.8	3.6	1.2	3.6	1.6	3.6	1.6	0.8	1.4
7	D.D.V.P.	4.5	2.4	4.5	2.1	4.5	2.6	4.5	2.5	3.9	2.5
8	Quinalphos	3.5	2.4	3.5	2.5	5.6	2.3	5.6	3.4	5.6	2.2
9	Monocrotophos	15.9	9.2	17.1	12.2	17.1	11.7	17.1	10.2	16.2	9.5
10	Phosphamidon	4.7	3.2	4.7	3.4	4.7	3.4	4.7	3.0	5.7	3.2
11	Phorate/Thimet	4.9	3.7	4.9	3.8	5.3	4.6	5.3	3.8	7.5	6.1
12	Ethion	1.3	1.2	1.3	1.5	1.9	1.3	1.9	1.8	5.1	3.4
13	Endosulphan	7.8	8.0	9.3	8.5	10.1	7.8	10.1	8.4	10.1	8.3
14	Fenvalerate	1.8	1.1	1.8	1.9	2.3	2.0	2.3	1.8	2.1	1.4
15	Cypermethirin	1.8	2.0	2.5	2.8	3.0	3.0	3.0	3.2	4.6	3.7
16	Anilophos	1.0	0.07	0.6	0.5	0.6	0.5	0.6	1.0	0.6	0.9
17	Acephate	0.5	1.4	2.9	2.6	4.8	3.7	4.8	4.8	4.8	2.9
18	Chlorpyriphos	2.3	1.1	3.7	1.6	7.4	3.6	7.4	7.2	10.3	7.5
19	Phosaslone	1.0	0.5	1.0	1.1	1.0	1.2	1.0	0.9	1.0	0.5
20	metasyspox	—	0.7	—	0.8	—	0.9	—	0.8	—	0.7
21	Abate	—	0.05	—	0.2	—	0.2	—	0.2	—	0.2
22	Fenthiom	—	0.2	—	0.2	—	0.2	—	0.2	—	0.2
23	Triazaphos	—	1.0	—	0.5	—	0.5	—	0.8	—	0.8
24	Lindane	1.2	0.7	1.2	0.8	1.2	0.8	1.2	0.9	1.3	1.1
25	Temphos	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
26	Deltamethrin	—	0.0	—	0.0	—	0.1	—	0.2	0.3	0.1
27	Alphamethrin	—	0.0	—	0.0	—	0.0	—	0.1	0.4	0.4
	Total	114.1	77.9	118.1	76.2	130.9	63.2	130.9	67.7	100.2	64.8

Source : Department of Chemicals & Petrochemical, Ministry of Chemicals & Fertilizers

TABLE 5.2.5(b) : CAPACITY AND PRODUCTION IN THE CHEMICAL INDUSTRY IN INDIA DURING 1995-96 TO 1999-2000 (FUNGICIDES, HERBICIDES, WEEDICIDES, RODENTICIDES, FUMIGANTS)

(In Thousand tonne)

S.No. Products	1995-96		1996-97		1997-98		1998-99		1999-2000	
	Inst. Cap.	Production	Inst. Cap.	Production	Inst. Cap.	Production	Inst. Cap.	Production	Inst. Cap.	Production
Fungicides										
1 Captan & Captafol	0.2	0.0	0.2	0.0	0.2	0.0	0.2	0.0	—	—
2 Thirm (Thiocarbamates)	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.2	0.4	0.0
3 Ziram (Thiocarbamates)	1.3	0.6	1.3	0.7	1.4	0.8	1.4	0.9	1.2	0.9
4 Carbendazim (Bavistin)	0.5	0.3	0.5	0.2	0.2	0.1	0.2	0.0	0.2	0.0
5 Calixin	4.3	4.6	6.5	7.1	8.5	7.0	8.5	8.3	11.0	10.3
6 Mancozev					—	0.1	—	0.2	1.5	0.2
Total	**6.7**	**5.7**	**8.9**	**8.2**	**10.7**	**8.2**	**10.7**	**9.6**	**14.3**	**11.4**
Herbicides										
1 2, 4-D	1.9	0.8	2.2	1.1	2.2	1.5	2.2	2.1	2.9	1.3
2 Butachlor	2.6	0.6	2.6	0.2	2.6	0.4	2.6	0.7	0.9	0.7
Total	**4.5**	**1.4**	**4.8**	**1.3**	**4.8**	**1.9**	**4.8**	**2.8**	**3.8**	**2.0**
Weedicides										
1 Isoproturon	7.0	6.3	7.0	5.9	7.0	5.5	7.0	4.6	8.5	4.6
2 Basalin	0.3	0.1	0.3	0.2	0.3	0.2	0.3	0.3	0.3	0.0
3 Glyphosate	1.8	0.9	1.8	1.0	1.8	1.1	1.8	1.3	1.8	1.7
4 Paraquat	2.0	7.1	2.0	1.1	2.0	0.0	2.0	0.0	4.0	1.4
5 Atrazine	—	0.1	—	—	—	—	—	—	0.0	0.1
6 Diuron	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0		0.0
7 Fluchloralin(Tech)	—	—	—	0.0	—	0.0	x	0.0	0.3	0.2
Total	**11.2**	**14.5**	**11.2**	**8.2**	**11.2**	**6.8**	**11.2**	**6.2**	**14.9**	**8.0**
Rodenticides										
1 Zinc Phosphide	0.9	0.4	0.9	0.4	0.9	0.5	0.9	0.6	0.9	0.5
Total	**0.9**	**0.4**	**0.9**	**0.4**	**0.9**	**0.5**	**0.9**	**0.6**	**0.9**	**0.5**
Fumigants										
1 Aluminium Phosphide	1.3	1.8	1.3	0.9	2.3	1.5	2.3	2.0	2.3	1.8
2 Methyl Bromide	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3	0.1
3 Dicofil	2.8	1.8	2.8	1.0	2.8	0.1	2.8	0.1	0.2	0.1
Total	**4.4**	**3.7**	**4.4**	**2.0**	**5.4**	**1.7**	**5.4**	**2.2**	**2.8**	**2.0**

Source : Department of Chemicals & Petrochemical, Ministry of Chemicals & Fertilizers.

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TABLE 5.2.6 : STATE-WISE CONSUMPTION OF PESTICIDES

(MT's Technical Grade)

S. No.	Name of State/ U.T.s	1994-95	1995-96	1996-97	1997-98	1998-99
1	Andhra Pradesh	9343	10957	8702	7298	4741
2	Arunachal Pradesh	19	22	20	18	18
3	Assam	432	316	300	284	260
4	Bihar	1462	1383	1039	1150	834
5	Goa	10	4	2	2	4
6	Gujarat	4985	4560	4545	4642	4803
7	Haryana	5100	5100	5040	5045	5035
8	Himachal Pradesh	280	300	300	200	276
9	Jammu & Kashmir	50	108	63	78	75
10	Karnataka	3640	3924	3665	2962	2600
11	Kerala	1384	1280	1141	602	1161
12	Madhya Pradesh	2771	1748	1159	1641	1643
13	Maharashtra	3647	5097	4567	3649	3468
14	Manipur	25	41	31	20	31
15	Meghalaya	17	20	20	8	9
16	Mizoram	21	21	18	17	16
17	Nagaland	11	9	9	9	9
18	Orissa	1580	1293	885	924	942
19	Punjab	7300	7200	7300	7150	6760
20	Rajasthan	3308	3210	3075	3211	3465
21	Sikkim	20	26	16	16	15
22	Tamil Nadu	3394	2080	1851	1809	1730
23	Tripura	12	25	22	19	16
24	Uttar Pradesh	7970	8110	7859	7444	7419
25	West Bengal	4370	4213	4291	3882	3678
26	Andaman & Nicobar Islands	10	7	9	4	5
27	Chandigarh	1	3	3	3	3
28	Dadra & Nagar Haveli	5	7	4	4	4
29	Daman and Diu	1	1	1	1	1
30	Delhi	58	76	61	65	64
31	Lakshadweep	1	1	1	1	1
32	Pondicherry	130	118	115	81	71
	All-India	**61357**	**61260**	**56114**	**52239**	**49157**

Source : Department of Chemicals and Petrochemicals.
Ministry of Chemicals & Fertilizers,

TABLE 5.2.7 : CONSUMPTION OF CHEMICAL FERTILIZERS

(Thousand Tonne)

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	8788.3	2669.3	908.4	12366.0
1994-95	9507.1	2931.7	1124.7	13563.5
1995-96	9822.8	2897.5	1155.8	13876.1
1996-97	10301.7	2976.8	1029.6	14308.1
1997-98	10901.7	3913.6	1372.5	16187.8
1998-99	11353.8	4112.2	1331.5	16797.5
1999-2000*	11886.0	4753.0	1733.0	18372.0

Source: Department of Chemicals and Petrochemicals
Ministry of Chemicals & Fertilizers,

* : Estimated.

TABLE 5.2.8 : INSECTICIDE LEVEL 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 5.2.9 : INSECTICIDE LEVEL IN WATER

Location	Year	No. of Samples		Insecticide	Residue	
		Analysed	Detected	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, Maharashtra,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 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 : MAJOR EARTHQUAKES IN INDIA

Date	Lattitude (degreeN)	Longitude (degree E)	Magni-tude	Yield in Mega/ othes at source	Region	Remarks
16-06-1819	24.00	70.00	8.0	12.59(0.62)	Kutch	About 2000 people killed
12-06-1897	25.00	92.00	8.7	63.1	Assam	One of the greatest earth quake of historical time Shillong city was razed to the ground 1542 killed.
04-04-1905	32.30	76.25	8.0	12.59(0.62)	Kangra	20000 lives lost
15-01-1934	26.60	86.80	8.3	25.12(1.25)	India-Nepal Border	Most severe in Indian history, More than 10000 killed
26-06-1941	12.40	92.50	8.1	15.85(0.79)	Andaman Islands	Flooding in port Blair
15-08-1950	28.46	96.66	8.5	39.81(1.99)	Assam	532 people killed
06-08-1988	25.14	95.12	5.8	0.79(0.04)	Burma-India Border	3 killed 11 injured
20-08-1988	26.78	86.61	6.5	0.04(0.02)	Nepal-India Border	1000 people killed, 1000 injured Extensive damage in Northern Bihar
19-10-1991	30.75	78.86	6.6	0.50(0.03)	West UP Hills (Uttarkashi)	768 people killed
30-09-1993	18.07	76.00	6.3	0.48(0.2)	Latur, Osmanabad	7601 people killed
22-05-1997			6.0		Jabalpur	38 People killed
29-03-1999	—	—	—	—	Uttar Pradesh	106 Human Lives lost, 395 Persons injured

Source : Ministry of Environment & Forests

The two third of India lies in the seismic zones of moderate to severe intensity. The Himalayan Range, the Indo-gangetic plains and the Kuthch and Kathaiwar region of Western India are geologically the most unstable parts, and are most prone to earthquakes. The Himalayan frontal arc flanked by the chaman fault in the west constitutes one of the most seismically active intra-continental regions in the world. In a span of 53 years, four earthquakes, exceeding magnitude 8 on the Richter scale, occurred in this region. These are the Assam earthquakes of 1897 and 1950, the Kangra earthquake of 1905 and the Bihar-Nepal earthquake of 1935. Besides the Himalayan regions, the Union Territories of Andaman and Nicobar Islands are also quite vulnerable to earthquakes. Peninsular India comprises stable continental crust regions, which are considered stable since they are away from tectonic activity of the boundaries. These regions are considered seismically the least active but the Latur earthquake in Maharashtra on September 30, 1993 of magnitude 6.4 in the Richter scale showed that this region, too, is unstable and earthquake prone.

The Department of earthquake engineering, University of Roorkee was established in 1960 to carry out Research and Development, Consultancy and Training in Earthquake Engineering. The Department helps in designing earthquake resistant structure. They use various techniques of seismic methods of geophysics in assessing the status of a locality.

TABLE 5.3.3 : LIST OF IDENTIFIED DROUGHT PRONE DISTRICTS IN THE COUNTRY

S.No. State/ District	No. of Talukas	Area of the	As per CWC's Study	
		District (Sq Km)	No. of Talukas affected by drought	Area affected by drought (Sq. Km)
I. Andhra Pradesh	**79**	**125113.03**	**19**	**32839.51**
1. Anantpur	11	19134.9	5	10455.8
2. Chittoor	11	15143.1	-	-
3. Cuddapah	9	15372.9	1	1473.7
4. Hyderabad	9	7762.49	3	3157.9
5. Kurnool	11	17600.4	2	3825.97
6. Mahboob Nagar	12	18472	3	4285
7. Nalgonda	7	14223.24	1	1772.05
8. Prakasam	9	17404	4	7869
II. Bihar	**15**	**43384.5**	**-**	**-**
9. Munger	4	7884.5	-	-
10. Nawadah	1	2494	-	-
11. Palamau	3	12019.9	-	-
12. Rohtas	2	7199.7	-	-
13. Bhojpur	2	3971.1	-	-
14. Aurangabad	1	3305	-	-
15. Gaya	2	6510.3	-	-
III. Gujarat	**124**	**121238.9**	**103**	**106818.4**
16. Ahmedabad	7	8565.9	5	7530.3
17. Amreli	10	6711.4	10	6711.4
18. Banaskantha	11	12404.3	9	11018.1
19. Bhawnagar	12	9786.3	12	9786.3
20. Bharuch	11	7805.7	11	7805.7
21. Jamnagar	10	10143	10	10143
22. Kheda	10	6888.1	3	2407
23. Kachchh	9	19476.5	9	19476.5
24. Mahesana	11	9011.8	3	2803.5
25. Panchmahal	11	8849.8	10	8975.1
26. Rajkot	13	11152.3	12	10667.7
27. Surender Nagar	9	10443.8	9	10443.8
IV. Haryana	**15**	**16587.85**	**8**	**8338.5**
28. Bhiwani	4	4657.38	4	4657.38
29. Gurgaon	5	4862.8	2	1462.44
30. Mahendergarh	3	3221.67	2	2218.68
31. Rohtak	3	3846	-	-
V. Jammu & Kashmir	**8**	**15999.3**	**2**	**2407.6**
32. Doda	4	11691	-	-
33. Udhampur	4	4308.3	2	2407.6

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TABLE 5.3.3 : LIST OF IDENTIFIED DROUGHT PRONE DISTRICTS IN THE COUNTRY—*Contd.*

S.No. State/ District	No. of Talukas	Area of the	As per CWC's Study	
		District (Sq Km)	No. of Talukas affected by drought	Area affected by drought (Sq. Km)
VI. Karnataka	**139**	**152163.33**	**42**	**57645.54**
34. Bangalore	11	7949.5	-	-
35. Belgaum	10	13460.8	1	1996
36. Bellary	8	9548.5	3	3994.3
37. Bijapur	11	17092.83	7	12477.44
38. Chikmangalur	7	7222	1	804.8
39. Chitradurga	9	10754.5	5	7477.5
40. Dharwar	17	13480.1	3	2772.32
41. Gulbarga	10	16167.8	5	8131
42. Hasan	8	6833.3	1	1277.8
43. Kolar	11	8215.2	4	3444.7
44. Mandya	7	4961	1	1034.28
45. Mysore	11	11947	1	1235.9
46. Raichur	9	13972.4	4	6347.6
47. Tumkur	10	10557.7	6	6651.9
VII. Madhya Pradesh	**47**	**87219.52**	**26**	**37307.93**
48. Betul	3	7062.9	-	-
49. Datia	2	2034	-	-
50. Dewas	5	6723.5	3	4219
51. Dhar	5	8195.41	4	6287
52. Jhabua	5	6792.8	5	6792.8
53. Khandwa	3	6379.6	1	1865
54. Khargone	8	13490	5	6955.37
55. Shahdol	4	13860.06	-	-
56. Shajapur	4	6178	3	4533.07
57. Sidhi	3	10390.75	1	3768.49
58. Ujjain	5	6112.5	4	4887.2
VIII. Maharashtra	**100**	**123767.05**	**45**	**57664.7**
59. Ahmednagar	13	16762.2	7	9491.8
60. Aurangabad	12	16385	2	3111.3
61. Bir	7	11169	3	4595
62. Nasik	13	15631.5	7	8098.9
63. Oosmandabad	11	14027	7	9515
64. Pune	14	15688.2	4	4932.1
65. Sangli	8	8610.25	5	5939.66
66. Satara	11	10436.9	4	3878.5
67. Solapur	11	15057	6	8102.5

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TABLE 5.3.3 : LIST OF IDENTIFIED DROUGHT PRONE DISTRICTS IN THE COUNTRY—*Concld.*

S.No. State/ District	No. of Talukas	Area of the	As per CWC's Study	
		District (Sq Km)	No. of Talukas affected by drought	Area affected by drought (Sq. Km)
IX. Orissa	**6**	**22862.41**	**1**	**2002.07**
68. Phulbani	3	11090.41	1	2002.07
69. Kalahandi	3	11771	-	-
X. Rajasthan	**76**	**218950.45**	**57**	**194203.27**
70. Ajmer	5	8449.6	3	4317.8
71. Banswara	5	5055	5	5055
72. Barmer	5	29521.4	5	29521.4
73. Bikaner	4	27396.4	4	27396.4
74. Churu	7	16861.35	7	16861.35
75. Dungerpur	3	3770	3	3770
76. Jaisalmer	2	41674.3	2	41674.3
77. Jalore	4	10554.4	3	8308.8
78. Jhunjhunun	4	5928	3	4460.2
79. Jodhpur	5	22633.8	5	22633.8
80. Nagpur	8	17628	8	17628
81. Pali	7	12211.2	2	4763.8
82. Udaipur	17	17267	7	7812.42
XI. Tamilnadu	**77**	**84091.14**	**8**	**7451.66**
83. Coimbatore	10	15603.79	-	-
84. Dharmapuri	8	9718.6	1	1227.8
85. Madurai	12	12264.1	-	-
86. Ramananthapuram	12	12575.49	3	3090.36
87. Salem	9	8543	-	-
88. Tiruchirapalli	10	11078.86	1	943.3
89. Tirunelveli	12	12505.5	3	2190.2
90. Kanyakumari	4	1701.8	-	-
XII. Uttar Pradesh	**31**	**43033.1**	**4**	**4609.4**
91. Allahabad	8	7255	-	-
92. Banda	5	7645.1	1	1354.4
93. Hamirpur	6	7192	1	1072
94. Jalaun	4	4549	2	2183
95. Mirzapur	4	11301	-	-
96. Varanasi	4	5091	-	-
XIII. West Bengal	**8**	**26720.8**	-	-
97. Bankura	2	6855.8	-	-
98. Midnapur	5	13606	-	-
99. Puruliya	1	6259	-	-
Total	**725**	**1081131.38 in 99 Districts**	**315**	**511288.64 in 74 Districts**

Source : Central Water Commission (N.W.P. Directorate)

TABLE 5.3.4 : DAMAGE DUE TO DROUGHTS, 1984–87

S.No.	Damage	1984	1985	1986	1987
1	Number of Districts affected	151	109	280	263
2	Population affected (lakh)	704.58	785.91	1919.42	2854.19
3	Cropped Area affected (lakh ha)	153.69	282.10	400.13	586.00
4	Cattle population affected (lakh)	475.06	654.30	1119.89	1681.11

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

TABLE 5.3.5 : FLOOD AFFECTED AREA & FLOOD DAMAGES IN INDIA (ABSTRACT FOR THE PERIOD 1953 TO 1997)

S.No.	Item	Unit	Average Flood Damage during 1953-97	Maximum Damage (with year)	Damage during 1997 (tentative)
1	Area Affected	Million ha.	7.44	17.50 (1978)	3.78
2	Population Affected	Million	32.22	70.45 (1978)	26.36
3	Human Lives Lost	No.	1502	11316 (1977)	909
4	Cattle Lost	No.	93728	618248 (1979)	25217
5	Crop Area Affected	Million ha.	3.48	10.15 (1988)	1.84
6	Value of damage to crops	Rs. Crore	455.34	2510.90 (1988)	411.80
7	Houses damaged	Million	1.13	3.51 (1978)	0.38
8	Value of damage to houses	Rs. Crore	136.02	741.60 (1988)	134.81
9	Value of damage to public utilities	Rs. Crore	394.85	2050.04 (1985)	994.65
10	Value of damage to houses, crops and public utilities	Rs. Crore	1012.60	4630.30 (1988)	1541.26

Source : Central Water Commission (FM&DP Directorate)

TABLE 5.3.6(a) : STATE-WISE DAMAGE DUE TO HEAVY RAINS, FLOOD, CYCLONE DURING SOUTH-WEST MONSOON —1999

(Provisional)

S. No.	State/UT's	Period/date of Occurrence	Calamity	Total districts (No.)	District affected (No.)	Villages Affected (No.)	Area Affected (Lakh Hectares)	Population Affected (Lakh)	Damage to crop Area (Lakh Ha.)	Damage to houses/ huts (No.)	Human Lives Lost (No.)	Animals Lost (No.)
1.	Arunachal Pradesh	1 June, 1999	H.R./L	12	1							
2.	Assam - I Wave	24 June, 1999	H.R./F	23	12	813	1.45	3.39	0.52	126	1	N.R.
	Assam - II Wave	23 Aug., 1999	H.R./F		10	923	1.48	5.37	0.54		2	
3.	Bihar	5 July, 1999	H.R./F	55	21	4028	7.4	60.56	2.82	23538	216	12
		22-29 Sep., 1999	H.R./C.R.		12	8812	0.62	15.72	0.62	225365	69	2016
4.	Gujarat	16 July-30 Aug. 1999	H.R./F	24	15						46	Nil
5.	Himachal Pradesh	July-Aug. 99	H.R./F	12	12	8461		22.05		2224	30	129
6.	Karnataka	12 July, 1999	H.R./F	27	27	3701	0.40	68.62	0.40	16828	122	959
7.	Kerala	25 May-8 Oct., 1999	H.R./F/Lig./L	14	14	1368				20083	131	
8.	Madhya Pradesh	20 Sep., 1999	H.R./F	45	7	1807	0.62	4.36	0.62	29168	27	654
9.	Orissa	7 Aug., 1999	H.R./F	30	7	2486	1.53	17.73	1.53		14	
10.	Punjab	12 July, 1999	H.R./F	17	3		0.02		0.02	2	11	
11.	Rajasthan	June-Sep., 1999	H.R./F	30	15						46	
12.	Tripura	9-12 July, 1999	H.R./F	4	2		0.2		0.05	4014	16	82
13.	Uttar Pradesh	18 Aug. 1999	H.R./F/Lan	83	11	620	0.39	1.84	0.33	1023	86	9
14.	West Bengal	25-26 June, 1999	Landslide	18	1					10		
	West Bengal	23-26 Sep. 1999	H.R./F	18	14			128.48		559527	79	
	Total			412	184	33019	14.11	328.12	7.45	881908	896	3861

Source : Natural Disaster Management, Ministry of Agriculture

F- Flood

L- Landslide

H.R. - Heavy Rains

C.R. - C

TABLE 5.3.6(b) : STATEWISE DAMAGE DUE TO HEAVY RAINS, FLOOD, CYCLONE DURING SOUTH-WEST MONSOON—2000

(As on 12-10-2000) Provisional)

S. No.	State/UT's	Calamity	Total districts (No.)	District affected (No.)	Villages Affected (No.)	Area Affected (Lakh ha)	Population Affected (Lakh)	Damage to crop Area (Lakh Ha.)	Estimated Value of Crops Damaged (Rs. in Crores)	Damage to houses/ huts (lakhs)	Estimated Value of Houses Damaged (Rs. in Crores)	Human Lives Lost (No.)	Animals Lost (No.)
1	Andhra Pradesh	HR/F	23	17	4522	—	29.35	4.22	0.95	1.04	963.64 +7.76 Billion-infra	257	5368
2	Arunachal Pradesh	H.R./F	12	4	—	—	—	NR	—	NR	—	26	NR
3	Assam	H.R./F/L	23	18	3474	4.43	36.09	2.24	250-300	NR	—	32	NR
4	Bihar	H.R./F	53	33	11559	5.98	78.74	3.9	222.81	2.81	117.56	273	1815
5	Gujarat	H.R./F	25	10	389	—	4.08	NR	NR	0.24	2.64	116	406
6	Himachal Pradesh	H.R./F/L	12	3	—	—	—	NR	NR	NR	—	100	NR
7	Karnataka			NR		—		0.57	—	0.55		152	690
8	Kerala	H.R./F/L	14	14	109	—	—	NR	27.43	0.9	5.59	75	NR
9	Madhya Pradesh	H.R./F	61	6	459	—	—	Neg.	—	0.3	—	13	147
10	Punjab	H.R./F	17	7	40	—	—	NR	Neg.	35	—	7	NR
11	Uttar Pradesh	H.R./F	83	39	2427	—	4.16	4.35	—		—	400	871
12	West Bengal	H.R./F	17	9	1412	—	204.12	19.20	1500	21.95	400	1320	83630
13	Sikkim	H.R./F/L	4	1	—	—	—	NR	—		—	11	NR
	Total		344	161	24391	10.41	356.54	34.48		63.13		2782	92927

Source : Natural Disaster Management, Ministry of Agriculture

Note : F- Flood
L- Landslide
HR - Heavy Rains
NR - Not Reported
Neg. - Negligible

TABLE 5.3.7 : STATEWISE DAMAGE DUE TO HEAVY RAINS, CYCLONE ETC. DURING PRE-MONSOON, 1999

(As on 8-12-99)

S. No.	State/UT's	Period/Date of Occurrence	Total districts (No.)	District affected (No.)	Villages Affected (No.)	Area Affected (Lakh Hectare)	Population Affected (Lakh)	Damage to crop Area (Lakh Ha.)	Value of Crop Area (Rs. lakh)	Damage to houses/ huts (No.)	Value of Houses Damaged (Rs. lakh)	Human Lives Lost (No.)	Animals Lost (No.)
1	Arunachal Pradesh	9 May, 1999	14	1			0.02			17		1	
2	Gujarat	17 May, 1999	24	3								453	
3	Kerala	4 Feb.–9 April, 1999	14	14	139	55.36		1.00	541.61	2898	72.07	25	

Source : Natural Disaster Management, Ministry of Agriculture

TABLE 5.3.8 : STATE-WISE DAMAGE DUE TO HEAVY RAINS, FLOOD AND SUPER CYCLONIC STORMS DURING NORTH-EAST MONSOON —1999

(As on 23-2-2000)

S No	State/UT's	Period/date of Occurrence	Calamity	Total districts (No.)	District affected (No.)	Villages Affected (No.)	Area Affected (Lakh Hectares)	Population Affected (Lakh)	Damage to crop Area (Lakh Ha.)	Damage to houses/ huts (No.)	Human Lives Lost (No.)	Animals Lost (No.)	No. of Persons Injured (No.)	Value of Crops Damaged (Rs. In Lakhs)
1	Andhra Pradesh	17-18 Oct. 99	Cyclone	23	1	1044		1.89		3425	3	388		
2	Kerala	22 oct.- 22 Nov. 99	H.R./Lig./Lan.	14	14	50				1218	21			110.35
3	Orissa	17-18 Oct. 99	Cyclone	30	4	5181	1.58	37.47	1.58	331580	199	10578	406	
		29-30 Oct. 99	Super Cyclone	30	12	14643	18.43	129.22	18.43	1828532	9887	444531	2507	
4	Tamilnadu	1st Oct. - 15 Dec. 99	Heavy Rains	30	29				0.20	36072	103	573		
5	West Bengal	28-29 Oct 99	Super Cyclone	18	4	1901 *	1.02	7.85	0.34	16240			2913	5773.00

Source : Natural Disaster Management, Ministry of Agriculture

* Mandals/Mouzas

TABLE 5.3.9(a) : INFORMATION ON DROUGHT-EXTENT OF DAMAGE, 1999-2000

(Provisional)

S. No.	State/UT's	District affected (No.)	Villages affected (No.)	Population affected Area (Lakh)	Damage to crop affected (Lakh Ha.)	Cattle Population (In Lakhs)
1	Andhra Pradesh	18	17431	—	15.22	—
2	Gujarat	17	9449	250000	—	71.33
3	Himachal Pradesh	12	—	—	2.87	—
4	Jammu & Kashmir	6	—	—	2.96	—
5	Karnataka	18	11078	55.38	22.84	—
6	Madhya Pradesh	4	5010	26.64	9.53	—
7	Manipur	5	—	—	0.71	—
8	Mizoram	3	—	—	0.51	—
9	Rajasthan	26	23406	261.79	78.18	345.60
10	Tripura	4	—	0.82	0.20	—
11	West Bengal	10	—	25.25	1.20	—

Source : Natural Disaster Management, Ministry of Agriculture
— : Not Available

TABLE 5.3.9 (b) : INFORMATION ON DROUGHT-EXTENT OF DAMAGE, 2000

(As on 10-11-2000)

(Provisional)

S No.	State/UT's	District affected (No.)	Villages affected (No.)	Population affected Area (Lakh)	Damage to crop affected (Lakh Ha.)	Cattle Population (Lakhs)
1	Gujarat	17	9449	250	NR	71.33
2	Madhya Pradesh	22	14851	26.64	9.53	34.28
3	Orissa	24	NR	NR	270	NR
4	Rajasthan	31	30583	32.5	87.49	400.00

Source : Natural Disaster Management, Ministry of Agriculture
NR : Not Reported

TABLE 5.3.10 : DAMAGE DUE TO EARTHQUAKE DURING, 1999

S No	State	Period of Occur-rence	Total districts (No.)	District affected (No.)	Villages Affected (No.)	Population Affected (Lakh)	Damage to houses/ huts (No.)	Human Lives Lost (No.)	Persons Injured (No.)	Animals Lost (No.)
1	Uttar Pradesh	29-3-99	85	6	804	3.72	2174	106	395	400

Source : Natural Disaster Management, Ministry of Agriculture

TABLE 5.3.11(a) : INCIDENCE OF ACCIDENTAL DEATHS(BY NATURAL CAUSES)

Year/State/U.T./ City	Avalan-che	Light-ning	Heat stroke	Flood	Cold & Expo-sure	Cycl-one/ Tornado	Starva-tion/ Thrist	Earth-quake/ Land slide	Epidemic	Torren-tial Rains	Other Natural Causes	Total
1995	106	1664	1677	822	618	180	183	537	1165	335	14313	21600
1996	61	1699	434	708	547	1104	442	483	180	110	13162	18930
1997	27	1957	393	580	743	73	227	396	82	129	14301	18908
1997												
State:												
Andhra Pradesh	-	77	62	38	25	11	17	16	5	36	383	670
Arunachal Pradesh	-	-	-	8	-	-	-	4	-	-	-	12
Assam	-	7	11	8	-	-	-	4	-	-	312	342
Bihar 1086		7	117	29	61	81	6	2	21	11	12	739
Goa	-	3	-	-	-	-	1	-	-	-	109	113
Gujarat	-	69	23	109	41	8	50	30	26	5	265	626
Haryana	1	1	-	-	15	1	22	4	-	-	145	189
Himachal Pradesh	6	3	1	26	30	-	6	22	-	-	131	225
Jammu & Kashmir	5	5	1	23	-	-	-	12	-	10	63	119
Karnataka	-	131	15	20	1	3	6	16	2	-	111	305
Kerala	-	47	5	8	-	-	-	33	-	11	181	285
Madhya Pradesh	-	547	18	81	27	5	43	31	2	6	-	760
Maharashtra	1	278	11	103	24	7	21	30	10	17	5175	5677
Manipur	-	-	-	-	-	-	-	-	-	-	11	11
Meghalaya	-	-	-	-	-	-	-	2	-	-	24	26
Mizoram	2	-	-	-	-	-	-	-	-	-	-	2
Nagaland	-	-	-	-	-	-	-	1	-	-	-	1
Orissa	-	276	24	1	6	-	-	14	5	-	506	832
Punjab	-	-	29	-	52	2	16	3	-	4	209	315

TABLE 5.3.11(a) : INCIDENCE OF ACCIDENTAL DEATHS(BY NATURAL CAUSES)—*Concld.*

Year/State/U.T./ City	Avalan-che	Light-ning	Heat stroke	Flood	Cold & Expo-sure	Cycl-one/ Tornado	Starva-tion/ Thrist	Earth-quake/ Land slide	Epidemic	Torren-tial Rains	Other Natural Causes	Total
Rajasthan	-	56	14	10	32	1	14	14	-	1	1485	1627
Sikkim	-	4	-	-	-	-	-	38	-	-	2	44
Tamil Nadu	-	69	65	44	7	-	-	14	3	7	2797	3006
Tripura	-	10	1	-	-	-	-	-	-	-	1	12
Uttar Pradesh	5	70	39	31	100	29	16	46	12	9	1263	1620
West Bengal	-	186	34	9	14	-	1	39	-	-	312	595
Union Territory:												
A. & N.Islands	-	1	-	-	-	-	-	-	-	-	-	1
Chandigarh	-	-	-	-	1	-	-	-	-	-	29	30
D. & N. Haveli	-	-	-	-	-	-	-	-	-	-	22	22
Daman & Diu	-	-	-	-	-	-	-	-	-	-	7	7
Delhi	-	-	11	-	287	-	-	2	6	10	19	335
Lakshadweep	-	-	-	-	-	-	-	-	-	-	-	-
Pondicherry	-	-	-	-	-	-	12	-	-	1	-	13

Source : National Crime Records Bureau, Ministry of Home Affairs

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TABLE 5.3.11(b) : INCIDENCE OF ACCIDENTAL DEATHS(BY UN-NATURAL CAUSES)

Year/State/U.T./ City	Air-Crash	Collapse of Stru-cture	Drowning	Electro-cution	Explo-sion	Falls	Factory/ Machine Accidents	Fire	Fire-Arms	Sudden deaths
1995	10	2881	21226	3861	581	5149	616	22922	1052	7598
1996	338	2050	20873	4303	563	5413	613	22649	1400	9749
1997	16	2126	21821	4583	933	6172	669	25166	1496	11041
1997										
State:										
Andhra Pradesh	-	159	1731	606	150	579	38	2141	20	600
Arunachal Pradesh	-	18	18	5	1	19	-	9	6	1
Assam	-	11	326	66	8	16	1	252	39	36
Bihar	-	99	713	71	6	135	15	566	51	185
Goa	-	9	161	9	8	55	6	56	1	46
Gujarat	-	202	1089	378	42	733	130	3198	1	799
Haryana	-	24	223	73	5	69	46	378	7	156
Himachal Pradesh	-	8	72	9	3	67	1	43	4	75
Jammu & Kashmir	-	3	35	16	88	95	-	48	165	46
Karnataka	3	103	1755	265	18	404	15	1758	1	625
Kerala	-	35	1264	87	13	282	10	283	1	412
Madhya Pradesh	-	390	4332	957	144	683	71	2406	143	1258
Maharashtra	2	273	5100	659	85	1189	75	8070	5	4366
Manipur	-	1	5	3	14	5	-	1	1	5
Meghalaya	-	1	12	7	-	9	-	9	3	-
Mizoram	-	1	4	1	-	3	-	-	1	11
Nagaland	-	-	4	-	-	-	-	-	6	-
Orissa	-	28	635	133	13	341	9	304	1	183
Punjab	-	8	201	106	45	69	15	452	16	173

TABLE 5.3.11(b) : INCIDENCE OF ACCIDENTAL DEATHS(BY UN-NATURAL CAUSES)—*Contd*

Year/State/U.T./ City	Air-Crash	Collapse of Structure	Drowning	Electro-cution	Explo-sion	Falls	Factory/ Machine Accidents	Fire	Fire-Arms	Sudden deaths
Rajasthan	4	211	1676	298	60	332	53	895	31	495
Sikkim	-	2	8	3	-	36	-	8	-	8
Tamil Nadu	1	255	1012	202	36	287	39	1867	50	390
Tripura	-	-	36	-	-	5	-	6	-	-
Uttar Pradesh	6	217	548	322	82	278	83	1097	886	277
West Bengal	-	31	593	135	87	191	16	582	38	460
Union Territory:										
A. & N.Islands	-	-	25	1	-	8	1	20	-	20
Chandigarh	-	1	2	7	-	18	-	26	1	37
D. & N. Haveli	-	-	19	-	-	7	-	4	-	6
Daman & Diu	-	-	14	5	-	3	-	13	-	2
Delhi	-	33	136	146	25	229	44	633	18	255
Lakshadweep	-	-	2	-	-	-	-	-	-	-
Pondicherry	-	3	70	13	-	25	1	41	-	114

Source : National Crime Records Bureau, Ministry of Home Affairs.

TABLE 5.3.11(b) : INCIDENCE OF ACCIDENTAL DEATHS(BY UN-NATURAL CAUSES)—Contd.

Year/State/U.T./ City	Killed by animals	Mines or quarry disaster	Poisoning	Stampede	Suffoca-tion	Traffic accidents	Other causes	Causes not known	Total
1995	804	349	20135	233	444	84803	14001	14222	222487
1996	735	447	18907	64	665	84775	13552	14068	201164
1997	771	614	21552	19	584	88474	14665	14293	214995
1997									
State:									
Andhra Pradesh	71	55	1372	1	13	9233	184	341	17294
Arunachal Pradesh	11	-	3	-	-	70	-	17	178
Assam	101	2	296	-	1	757	502	533	2947
Bihar	21	19	579	2	20	2887	309	237	5915
Goa	1	1	5	-	2	226	97	11	694
Gujarat	78	12	1036	2	43	5944	814	129	14630
Haryana	5	20	408	-	-	2646	246	93	4399
Himachal Pradesh	2	-	141	-	13	729	86	32	1285
Jammu & Kashmir	3	-	48	-	-	2054	-	15	2616
Karnataka	29	11	1113	-	2	6086	9	1718	13915
Kerala	16	4	103	-	5	3005	340	219	6079
Madhya Pradesh	103	116	4798	-	135	6254	-	3850	25640
Maharashtra	76	192	4240	4	109	11636	7791	2711	46583
Manipur	-	-	1	-	-	105	3	21	165
Meghalaya	6	-	-	-	-	61	9	19	136
Mizoram	1	-	-	-	-	32	-	4	58
Nagaland	-	-	-	-	-	58	-	-	68
Orissa	75	-	790	-	17	1912	426	685	5552
Punjab	6	30	410	-	1	1300	226	158	3216
Rajasthan	31	114	864	-	70	5638	957	598	12327
Sikkim	-	-	7	-	-	24	19	16	131

TABLE 5.3.11(b) : INCIDENCE OF ACCIDENTAL DEATHS(BY UN-NATURAL CAUSES)—*Concld.*

Year/State/U.T./ City	Killed by animals	Mines or quarry disaster	Poison-ing	Stampede	Suffoca-tion	Traffic accidents	Other causes	Causes not known	Total
Tamil Nadu	17	12	2824	6	2	8761	401	583	16745
Tripura	1	-	-	-	-	147	-	-	195
Uttar Pradesh	37	11	1310	1	50	10053	1219	472	16949
West Bengal	61	13	977	3	35	5369	333	1576	10500
Union Territory:									
A. & N.Islands	2	-	6	-	-	16	31	3	133
Chandigarh	-	-	21	-	2	149	32	-	296
D. & N. Haveli	9	-	3	-	-	40	5	7	100
Daman & Diu	-	-	2	-	-	14	3	-	56
Delhi	8	2	176	-	64	3124	567	237	5697
Lakshadweep	-	-	-	-	-	-	-	-	2
Pondicherry	-	-	19	-	-	144	56	8	494

Source : National Crime Records Bureau, Ministry of Home Affairs

Notes :

1. Poisioning includes the incidence due to food poisoning / Accidental intake insects, spurious/poisoning liquor, leakage of poisoning gases etc., snake bite/ Animal bite and others.
2. Traffic Accidents includes Road accidents, Rail road accidents and other railway accidents.

TABLE 5.4.1 : NUMBER OF MINES IN INDIA

S. No.	State	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000
1	Andhra Pradesh	434	431	418	412	406	383
2	Arunanchal Pradesh	1	0	0	0	0	0
3	Assam	9	8	9	9	9	10
4	Bihar	369	371	360	335	331	314
5	Goa	83	81	77	74	76	73
6	Gujarat	524	510	475	461	443	436
7	Haryana	21	25	19	31	29	27
8	Himachal Pradesh	35	34	36	39	38	33
9	Jammu & Kashmir	6	5	6	5	6	7
10	Karnataka	241	236	236	207	202	194
11	Kerala	43	47	51	54	54	46
12	Madhya Pradesh	569	546	552	514	511	479
13	Maharashtra	146	148	155	148	142	133
14	Manipur	1	1	1	1	0	0
15	Meghalaya	2	2	2	2	2	2
16	Orissa	276	264	257	238	239	221
17	Rajasthan	674	616	579	526	501	469
18	Sikkim	1	1	1	2	2	2
19	Tamilnadu	129	133	126	124	130	118
20	Uttar Pradesh	55	51	51	43	37	28
21	West Bengal	127	124	130	129	125	125
	Total	3746	3634	3541	3354	3283	3100

Source : Indian Bureau of Mines.

The number of mines are showing declining trend. The decline is about one fifth during last five years. The States of Rajasthan, Madhya Pradesh, Karnataka, Gujarat and Bihar has also shown similar trend. The number of mines increased in the State of Kerala in the year 1997-98 has also decreased in the year 1999-2000.

TABLE 5.4.2 : PRODUCTION OF MINERALS

S. No.	Minerals	Unit	Production				
			1995-96	1996-97	1997-98	1998-99	1999-2000
1	Coal	000 t	273415	286080	296656	292270	299996
2	Lignite	000 t	22144	22540	23052	23419	21847
3	Natural Gas	M.c.m.	20929	21324	24544	25706	26884
4	Petroleum	000 t	34517	32900	33858	32722	32011
5	Bauxite	Tonne	5564775	6076217	6108214	6609525	6854425
6	Chromite	Tonne	1699534	1455849	1515286	1418119	1696040
7	Copper Ore	Tonne	4747683	3904772	4514615	4229996	3120721
8	Copper (Conc.)	Tonne			223328	198510	165001
9	Gold	Kg.	2036	2710	2846	2683	2442
10	Gold (ore)	Tonne	453334	476225	437475	644059	574053
11	Iron Ore	000 t	67418	68161	75723	72230	73475
12	Lead Conc.	Tonne	61583	60271	60881	62842	62865
13	Lead & Zinc (Ore)	Tonne	2386894	2263982	2483419	2650854	2743400
14	Manganese Ore	Tonne	1836705	1870783	1641963	1537693	1565483
15	Silver	Kg.	35531	39689	53956	55409	53627
16	Tin Conc.	Kg.	54991	31184	39351	39391	22812
17	Tungsten Conc.	Kg.	6451	3826	0	0	0
18	Zinc Conc.	Tonne	289072	276992	292524	349934	359924
19	Agate	Tonne	542	400	239	154	120
20	Apatite	Tonne	10777	9147	7150	14031	11642
21	Asbestos	Tonne	23844	27180	26034	20111	18304
22	Ball Clay	Tonne	507681	492207	464201	448949	404241
23	Barytes	Tonne	442733	381832	453073	600854	204569
24	Calcareous Sand	Tonne	312652	107968	32008	14067	0
25	Calcite	Tonne	74705	37254	51686	61908	59373
26	Chalk	Tonne	147293	123336	114838	118623	140027
27	Clay (Others)	Tonne	75117	69304	93855	95671	206121
28	Corundum	Kg.	1416	3758	945	807	19
29	Corundum (Ruby)	Kg.	215	168	400	0	0
30	Diamond	Carat	29931	31836	30994	34580	40666
31	Diaspore	Tonne	10287	14874	6956	9334	10781
32	Dolomite	Tonne	3717541	3468622	2990857	2921748	2874687
33	Dunite	Tonne	171491	158808	193777	230203	229667
34	Emerald	Kg.	0	0	0	0	0
35	Felsite	Tonne	1183	1209	1481	657	656
36	Felspar	Tonne	106896	101697	112238	116351	161800
37	Fire Clay	Tonne	452817	406695	450214	469721	368781
38	Flourite (Conc.)	Tonne	22944	19926	11338	48	220
39	Flourite (Graded)	Tonne	4099	5135	5519	4025	47852
40	Fuch. Quartzite	Tonne	17	1	0	195	70
41	Garnet (Abrasive)	Tonne	62314	42296	76946	133107	190758
42	Garnet (Gem)	Kg.	602	654	742	950	737
43	Graphite R.O.M.	Tonne	136263	117761	112786	135668	108821

TABLE 5.4.2 : PRODUCTION OF MINERALS—*Concld.*

S. No.	Minerals	Unit	Production				
			1995-96	1996-97	1997-98	1998-99	1999-2000
44	Gypsum	Tonne	2195111	2209937	2195423	2267240	3287782
45	Jasper	Tonne	4780	5059	6119	5570	5445
46	Kaolin	Tonne	831098	775283	790802	740542	752340
47	Kyanite	Tonne	8944	6996	6068	6134	6485
48	Laterite	Tonne	677173	661843	591875	594665	736455
49	Lime Kankar	Tonne	307050	330154	378844	252125	206732
50	Lime Shell	Tonne	105973	80015	82294	91761	91223
51	Lime Stone	000 t	96832	102723	110442	113213	127891
52	Magnesite	Tonne	345077	377510	373520	349852	329790
53	Mica(Crude)	Tonne	1832	1954	1697	1484	1273
54	Mica(Waste & SCR)	Tonne	1240	1109	909	1067	1039
55	Ochre	Tonne	346682	322383	358155	375371	409131
56	Perlite	Tonne	452	310	80	207	383
57	Phosphorite	Tonne	1308551	1340836	1141671	1262238	1135595
58	Pyrites	Tonne	141000	143602	125474	88730	9539
59	Pyrophyllite	Tonne	144050	141655	103022	91924	115316
60	Quartz	Tonne	139283	178378	209133	254235	227128
61	Quartzite	Tonne	116085	111110	58714	45109	62603
62	Salt(Rock)	Tonne	1827	2700	2801	2607	2812
63	Sand (Others)	Tonne	1723559	1642881	2060426	2589600	2095606
64	Shale	Tonne	302959	467283	614198	816492	779950
65	Silica Sand	Tonne	1146418	1540321	1451156	1718325	3153082
66	Sillimanite	Tonne	9086	8528	12458	12123	14936
67	Slate	Tonne	9696	7826	10655	9711	9839
68	Steatite	Tonne	540570	531224	474541	481554	527687
69	Sulphur	Tonne	19826	8820	12852	14889	24823
70	Vermiculite	Tonne	1798	4064	4699	4274	2792
71	Wollasttonite	Tonne	96017	97330	97742	94700	116880

Source : Indian Bureau of Mines.

810 SPI/2001—23A

TABLE 5.4.3 : STATUS OF AFFORESTATION AND TREES SURVIVED UPTO 1998-99 IN MINING AREAS

(Area in hectare)

S. No.	Minerals	Mines Covered	Area Covered	Trees Planted	Trees Survived	Survival Rate (%)
1	Bauxite	49	1365.29	4751209	3673604	77
2	Chromite	14	289.97	1433543	860126	60
3	Copper	7	324.38	1256264	778884	62
4	Dolomite	38	269.05	470838	320169	68
5	Gold	5	412.00	906400	634480	70
6	Iron Ore	128	7255.00	19769875	14036611	71
7	Iron and Manganese	31	165.32	495960	371970	75
8	Lead and Zinc	7	1330.00	665000	585200	88
9	Limestone	235	7074.29	11672578	8637708	74
10	Manganese	57	1887.10	4906460	3140138	64
11	Magnesite	16	483.00	422625	286358	68
12	Pyrite	1	7.00	19250	13290	69
13	Others	224	1292.79	2352496	1510229	64
	Total	812	22155.19	49122498	34848767	71

Source : Indian Bureau of Mines.

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TABLE 5.4.4 : MINING MACHINERY IN METALLIFERROUS OPENCAST MECHANISED MINES DURING 1998-99 (EXCLUDING FUEL, ATOMIC AND MINOR MINERALS)

S. No.	Machinery	In Use	In Reserve
1	Dipper Shovels	629	68
2	Loaders	478	23
3	Bulldozers	463	37
4	Motor Graders	71	4
5	Haulers/Dumpers	3808	299
6	Drills	908	176
7	Crushers	271	15
8	Air Compressors	758	114
9	Locomotives	33	9
10	Hydraulic Excavators	275	9
11	Cranes	116	16
12	Surface Miner	5	—

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	1997-98	1998-99
Gun Powder	Tonnes	54	93	124	354	97	71	43
High Explosive	Tonnes	40270	42075	48235	44110	41295	44925	46237
Liquid Oxygen	Tonnes	252	189	211	176	129	208	364
Detonators	No.(000)	15588	14580	16195	14336	13452	14257	12914
Fuse	m.(000)	23028	23907	26044	23977	22820	24729	25988

Source : Indian Bureau of Mines.

TABLE 5.4.6: INFORMATION ON REHABILITATION OF MINING LAND/RECLAIMATION OF ABANDONED MINES

	For the year 1998-99	Cumulative
No. of abandoned mines	8	18
No. of abandoned mines reclaimed	4	12
Total of area reclaimed in abandoned mines (hect.)	2.34	438.54
No. of mines (working) where reclaimation/rehabilitation is being carried out	50	237
Area of such reclaimed/rehabilitation in working mines(in hect.)	328.67	3352.11

Source : Indian Bureau of Mines.

CHAPTER SIX

WATER

India is rich in surface water resources. Average annual precipitation is nearly 4000 cubic km. And the average flow in the river system is estimated to be 1880 cubic km. Because of concentration of rains only in the three monsoon months, the utilizable quantum of water is about 690 cubic km. 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 assumption that "Fresh water is a gift of God which would continue to be available in perpetuity and in abundance" is under challenge. The main preoccupation of water resources 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. The agriculture production technologies have put a lot of stress on underground water resources in few areas. The subsidy on electricity and irrigation are other contentious issues with which authorities are struggling.

RIVER WATER

Rivers are the lifeline of majority of population in cities, towns and villages and most of these are considered as sacred. Every river stretch has a distinct water use like bathing, drinking, municipal supply, navigation, irrigation and fishing, sports etc. Simultaneously it is also used as receptacle for discharge of industrial effluent, municipal sewage and dumping of solid wastes. The Water (Prevention and Control of Pollution) Act, 1974 is aimed to support the quality of various designated best uses of water bodies. The water Quality Atlas of the Indian River System has been prepared by CPCB on the basis of five major uses of the river water such as :

(a) Drinking water source without conventional treatment but after disinfection;
(b) Outdoor bathing organized;
(c) Drinking water source but with conventional treatment followed by disinfection;
(d) Propagation of wildlife, fisheries;
(e) Irrigation, industrial cooling, controlled waste disposal.

For maintaining the quality of river water, the pollution levels in rivers have been detected by monitoring limited number of the physico-chemical parameters, which could only determine the changes in chemical characteristics of water bodies. Deterioration in water quality, over the past several years has gradually rendered the river water quality unsuitable for various beneficial purposes.

MONITORING OF RIVERS

The river water quality monitoring is most essential aspect of restoring the water quality. The Central Pollution Control Board (CPCB) has undertaken the responsibility to monitor the quality of water through 495 monitoring stations located in various water bodies all over the country. This is done through three major schemes (1) Global Environmental Monitoring System (GEMS)- 50 stations, (2) Monitoring of Indian National Aquatic Resources (MINARS) - 430 stations and (3) Yamuna Action Plan (YAP) - 15 stations.

BIOLOGICAL WATER QUALITY EVALUATION AND CRITERIA

There are two methods adopted for water quality evaluation which are complementary to each other.

1. Saprobic Score (BMWP)

   This methodology involves inventory of the presence of benthic macro-invertibrate fauna up to the family level with the taxonomic precision. All possible families having saprobic indicator value are classified on score scale of 1 to 10 according to their preference for saprobic water quality. The saprobic scores of all the families are registered and averaged to produce BMWP score.

2. Diversity Score (Sequential Comparison)

   This method involves pairwise comparison of sequentially encountered individuals and the difference of two benthic animals can be observed upto the species level, where no taxonomic skill is required. The diversity is the ratio of total no. of different animals (runs) and the total number of organisms encountered. The ratio of diversity has a value between 0 and 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 fertilizers 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 13 major water polluting industries have been identified and are closely being monitored by the Central Pollution Control Board.

Access to safe drinking water remains an urgent need as only 70.5% of the households in the urban area and 8.7 % in rural areas receive organized piped water-supply and the rest have to depend on surface or ground water which is untreated (Statistical Abstract of India, 1998). 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 higher 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. For industries surface water is the main source for drawing water and discharging effluents. Industrial wastes containing heavy metals such as mercury, chromium, lead and arsenic can threaten or destroy marine life besides polluting aquatic food resources.

Feeding of Crocodile in the Bharatpur Crocodile Sanctuary. Sundarbans

TABLE 6.1.1 : PERFORMANCE OF MONSOON

Year	As Percentage of Normal Rainfall
1976	102
1977	104
1978	109
1979	81
1980	104
1981	100
1982	85
1983	113
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
1997	102
1998	106
1999	96

Source : "Economic Survey - 1999-2000", Ministry of Finance

TABLE 6.1.2 : SUB DIVISIONAL ACTUAL AND NORMAL RAINFALL

(millimetre)

	Sub Divisions	1996		1997		1998		1999	
		Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal
1.	Andaman & Nicobar Islands	2975.2	3098.8	2355.7	2967.9	2842.9	2964.7	2103.8	2963.6
2	Arunachal Pardesh	4962.7	4357.0	2742.6	2928.0	3794.0	2945.4	2739.1	2956.3
3.	Assam and Meghalaya	2310.4	2440.0	2432.5	2882.7	2992.6	2875.1	2599.0	2809.2
4	Nagaland,Mizoram, Manipur and Tripura	1947.0	2043.0	1830.9	1910.9	1827.7	1910.8	1874.3	2008.0
5.	Sub-Himalayan West Bengal & Sikkim	2920.5	2773.1	2350.9	2683.1	3274.5	2683.7	2897.1	2683.6
6.	Gangatic West Bengal	1423.8	1457.8	1670.5	1444.5	1570.4	1448.3	1842.7	1449.2
7.	Orissa	996.9	1459.3	1556.8	1489.8	1306.2	1450.3	1527.6	1497.8
8.	Bihar Plateau	1254.7	1337.2	1494.9	1308.4	1457.2	1306.2	1762.7	1313.9
9.	Bihar Plain	1262.5	1241.3	1347.6	1180.0	1322.3	1178.1	1432.7	1178.2
10.	Uttar Pardesh East	1104.5	1055.9	1068.0	1022.2	1137.0	1029.6	1034.4	1020.7
11.	Plains of Uttar Pradesh West	1097.3	887.6	938.8	891.1	1056.0	911.6	847.5	892.0
12.	Hills of Uttar Pradesh West	1662.1	1733.4	1450.8	1674.5	1846.0	1652.8	1488.7	1668.0
13.	Haryana,Chandigarh & Delhi	953.1	727.0	875.5	617.0	888.0	604.0	463.7	617.4
14.	Punjab	820.2	757.6	896.7	646.3	837.4	631.6	571.1	649.0
15.	Himachal Pardesh	1604.3	1839.6	1385.1	1344.3	1349.2	1320.7	1109.9	1340.6
16.	Jammu & Kashmir	1666.8	1128.3	1045.4	979.5	973.7	1116.6	762.9	1042.9
17.	Rajasthan West	446.8	322.9	568.1	319.4	376.1	313.8	245.8	312.8
18.	Rajasthan East	886.3	700.8	800.0	679.6	673.0	681.2	532.8	679.7
19.	Madhya Pradesh West	982.7	1040.2	1118.3	1012.0	910.5	987.3	1160.5	1013.0
20.	Madhya Pradesh East	1123.6	1354.5	1274.1	1307.8	1013.2	1265.5	1311.9	1307.5
21.	Gujarat Region	829.6	846.4	1408.7	1091.2	1399.6	1119.8	916.7	1113.1
22.	Saurashtra, Kutch & Diu	502.3	537.1	660.2	852.3	707.0	581.5	347.1	582.1
23.	Konkan & Goa	2582.4	2754.7	2930.0	3002.2	3251.7	2998.4	2894.1	3001.5
24.	Madhya Maharastra	778.1	763.5	1049.1	902.6	1142.0	902.5	874.2	902.3
25.	Marathwada	884.9	800.1	794.2	847.1	1215.2	845.3	845.0	845.6
26.	Vidarbha	797.1	1099.4	1068.8	1112.8	1125.1	1087.5	1119.2	1111.0
27.	Coastal Andhra Pradesh	1300.3	949.3	1093.0	1044.8	1285.2	1017.0	848.0	1033.5
28.	Telangana	929.8	970.6	864.7	932.7	1140.0	923.3	865.5	945.0
29.	Rayalaseema	1277.4	733.3	805.5	675.4	963.1	664.9	584.5	679.0
30.	Tamilnadu	1343.1	1023.5	1205.1	993.8	1034.7	983.6	784.2	985.6
31.	Coastal Karnataka	3355.2	3560.5	4144.6	3467.4	4160.3	3653.4	3972.1	3654.4
32.	North Interior Karnataka	766.4	824.5	750.8	739.9	939.3	698.6	736.0	698.0
33.	South Interior Karnataka	838.3	895.0	1265.8	1124.6	1221.5	1071.7	1209.0	1070.6
34.	Kerala	2457.2	2718.6	3213.9	3106.0	3116.3	3077.9	2872.3	3106.2
35.	Lakshadweep	1601.7	1579.9	1764.3	1491.8	1977.6	1468.4	1857.8	1494.2

Source : Indian Meteorological Department , Ministry of Science and Technology.

TABLE 6.1.3 : ANNUAL RAINFALL BY METEOROLOGICAL SUB -DIVISION

(millimetre)

Sub-division		Actual Rainfall								
		1990	1991	1992	1993	1994	1995	1996	1997	1998
1.	Andaman and Nicobar Islands	2256.9	2465.6	2292.6	2428.1	3044.9	3102.1	3165.0	2355.7	2842.9
2.	Arunachal Pradesh	5720.5	3309.2	1970.2	2839.3	2141.3	2938.9	2589.7	2742.6	3794.0
3.	Assam and Meghalaya	2426.7	2206.1	2214.5	2993.0	2350.4	2706.1	2635.0	2432.5	2992.6
4.	Nagaland, Mizoram, Manipurand Tripura	2265.7	2513.4	1680.5	2384.0	1412.5	1670.0	1559.4	1830.9	1827.7
5.	Sub-Himalayan,West Bengal & Sikkim	2762.8	3105.6	2027.4	2779.1	1868.6	2896.3	2531.1	2350.9	3274.5
6.	Gangetic West Bengal	2167.1	1969.1	1139.7	1663.5	1457.2	1738.6	1399.5	1670.5	1570.4
7.	Orissa	2004.0	1583.5	1350.0	1395.0	1759.8	1725.9	1042.4	1556.8	1306.2
8.	Bihar Plateau	1738.0	1505.7	983.0	1224.4	1470.0	1402.8	1215.8	1494.9	1457.2
9.	Bihar Plains	1011.1	1024.1	780.5	1209.5	957.9	1088.7	1124.0	1347.6	1322.3
10.	Uttar Pradesh East	1183.0	833.7	842.3	853.8	985.4	904.5	1047.1	1068.0	1137.0
11.	Plains of Uttar Pradesh West	839.3	644.6	784.0	775.8	851.8	869.5	953.4	938.8	1056.3
12.	Hills of Uttar Pradesh West	1759.9	856.0	1316.1	1427.5	1269.0	1398.0	1259.2	1450.8	1846.9
13.	Haryana,Chandigarh & Delhi	910.5	586.4	527.5	661.4	749.3	1066.6	872.2	875.5	888.4
14.	Punjab	1047.6	662.1	561.5	693.3	672.8	877.1	747.0	896.7	837.4
15.	Himachal Pradesh	1767.3	1319.9	1261.3	1186.0	1420.5	1458.5	1247.4	1385.1	1349.2
16.	Jammu & Kashmir	1238.5	1132.3	1411.5	656.3	1094.5	893.7	1135.8	1045.4	973.7
17.	Rajasthan West	545.8	166.7	606.2	366.0	509.2	458.4	456.7	568.1	376.1
18.	Rajasthan East	750.4	482.7	801.7	705.9	862.9	808.8	942.2	800.0	673.0
19.	Madhya Pradesh West	1191.8	839.4	833.1	1067.4	1351.7	927.1	1142.6	1118.3	910.5
20.	Madhya Pradesh East	1596.4	1203.5	1127.4	1230.8	1742.0	1220.8	1125.2	1274.1	1013.2
21.	Gujara Region,Daman, Dadra & Nagar Haveli	948.8	536.7	1135.7	1298.7	1933.0	881.9	1182.0	1408.7	1399.6
22.	Saurashtra,Kutch & Diu	440.3	299.4	597.1	412.5	772.3	402.9	480.0	660.2	707.0
23.	Konkan & Goa	3328.7	2682.5	2727.4	3229.7	3068.4	2692.9	2656.0	2930.0	3251.7
24.	Madhya Maharashtra	876.8	781.3	810.3	1060.7	1105.8	897.8	966.0	1049.1	1142.0
25.	Marathwada	1339.4	665.3	732.3	825.4	608.5	864.1	844.1	794.2	1215.1
26.	Vidarbha	1551.6	817.2	1079.4	980.0	1443.3	1089.9	843.6	1068.8	1125.1
27.	Coastal Andhra Pradesh	1415.7	1185.2	945.3	877.1	1034.5	1354.3	1251.4	1093.0	1285.2
28.	Telangana	1284.7	866.3	791.0	807.1	882.4	1246.8	1014.8	864.7	1140.0
29.	Rayalaseema	891.7	893.9	571.5	818.6	579.5	759.6	1280.1	805.5	963.1
30.	Tamil Nadu and Pondicherry	1058.2	969.1	953.7	1170.7	952.5	864.9	1231.9	1205.1	1034.7
31.	Coastal Karnataka	3953.0	3798.5	3780.8	3431.2	4360.1	3663.5	3121.5	4144.6	4160.3
32.	North Interior Karnataka	750.3	855.9	724.6	810.8	701.2	646.5	883.4	750.8	939.3
33.	South Interior Karnataka	744.4	1149.7	1325.8	1171.9	1319.6	1024.9	1231.2	1265.8	1221.5
34.	Kerala	2364.2	2836.6	3294.1	2816.1	3431.4	2888.6	2683.6	3213.9	8116.3
35.	Lakshadweep	1324.9	1610.6	1581.8	1473.3	1566.8	1747.6	1603.1	1764.3	1977.6

Source : Indian Meteorological Department, Ministry of Science & Technology.

Notes : Data for the year 1991 are based on observatory data while the figures for 1992 onward are based on Districtwise rainfall monitoring scheme data.

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TABLE 6.1.4 : STATE-WISE DISTRIBUTION OF NO. OF DISTRICTS 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

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

Legend :

E : Excess N : Normal

D : Deficient S : Scanty

NR : No Rain ** : Data Inadequate

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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

State	Districts
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. hiruvananthapuram
	2. Wynad

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

TABLE 6.1.6 (a) : NUMBER OF METEOROLOGICAL SUB-DIVISIONS WITH EXCESS/NORMAL AND DEFICIENT/SCANTY RAINFALL AT THE END OF MONSOON SEASON (JUNE—SEPTEMBER)

Year	No. of Sub-Divisions	
	Excess/Normal	Deficient/Scanty
1991	27	8
1992	32	3
1993	31	4
1994	25	10
1995	33	2
1996	32	3
1997	32	3
1998	33	2
1999	28	7
2000	28	7

Source : India Meteorological Department

TABLE 6.1.6(b) : PERCENTAGE OF DISTRICTS WITH EXCESS/NORMAL AND DEFICIENT/SCANTY RAINFALL AT THE END OF MONSOON SEASON (JUNE-SEPTEMBER)

Year	Percentage of Districts	
	Excess/Normal	Deficient/Scanty
1991	68	32
1992	65	35
1993	78	22
1994	77	23
1995	79	21
1996	82	18
1997	81	19
1998	83	17
1999	67	33
2000	66	34

Source : India Meteorological Department.

CHART 12(a) : NUMBER OF METEOROLOGICAL SUB- DIVISIONS WITH EXCESS/ NORMAL AND DEFICIENT/ SCANTY RAINFALL AT THE END OF MONSOON SEASON (JUNE-SEPTEMBER)

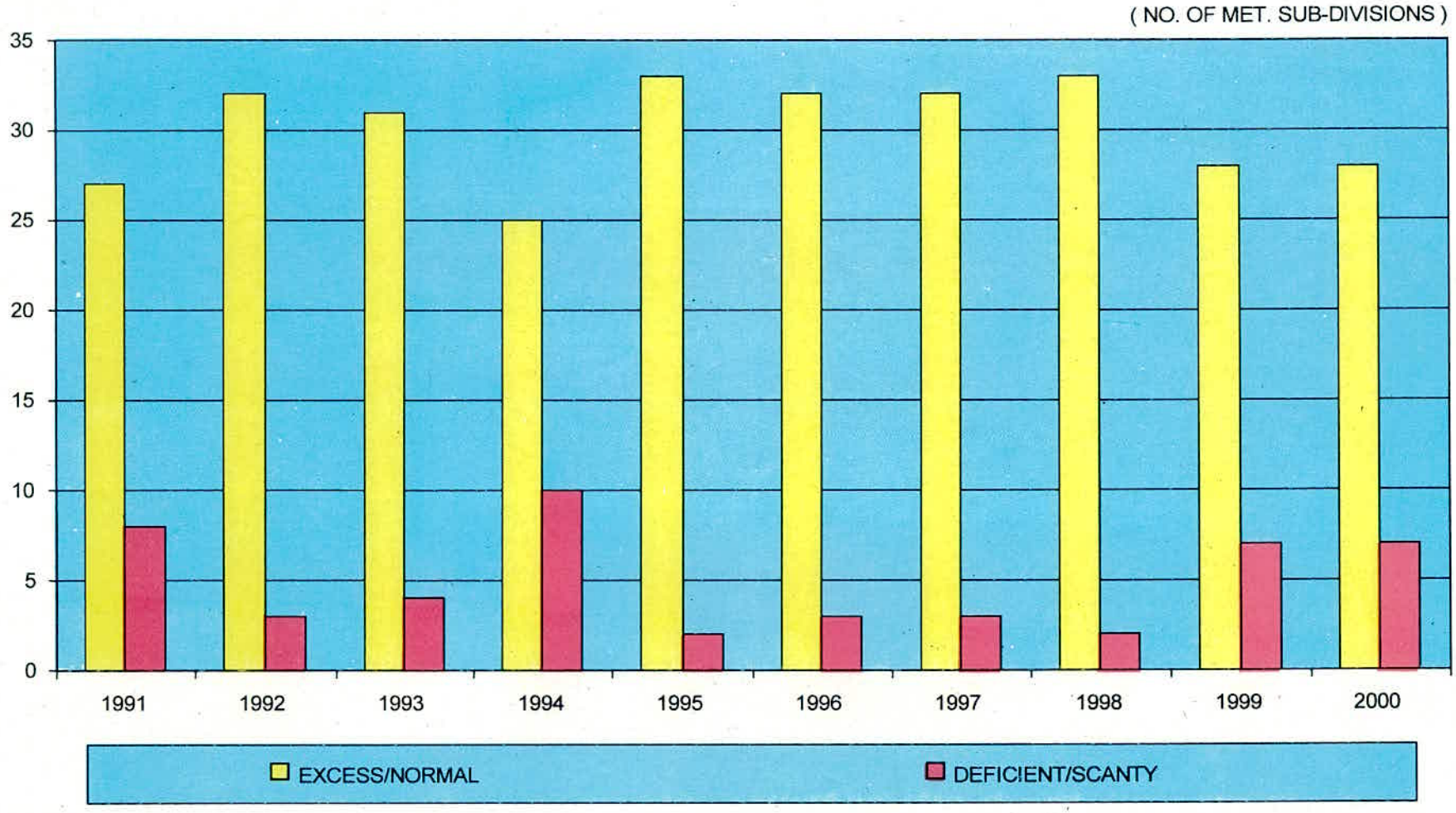

CHART 12(b) : PERCENTAGE FO DISTRICTS WITH EXCESS/ NORMAL AND DEFICIENT/ SCANTY RAINFALL AT THE END OF MONSOON SEASON (JUNE-SEPTEMBER)

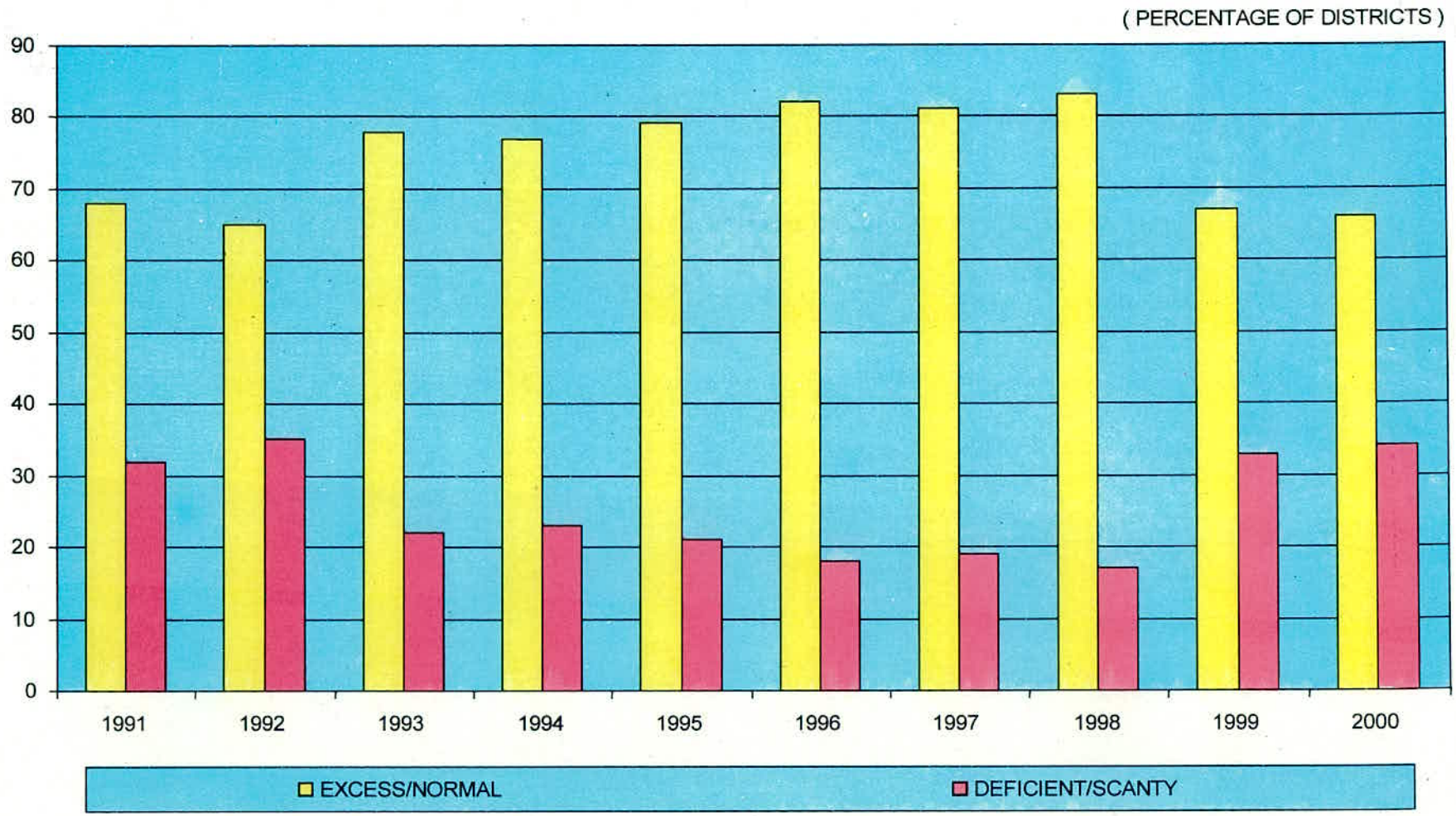

TABLE 6.1.7 : WATER FLOW IN STREAMS FOR THE YEAR 1996-97

(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	3561.00	882.90	0.160	4.888
Narmada	Dindori	Gurudeshwar	19	1415.00	23721.00	1.026	23.180
Godavari	Chass	Polavaram	53	985.30	11290.00	0.000	174.200
Cauvery	Kudige	Musiri	16	2265.00	6949.00	0.200	0.357
Krishna@	Karad	Vijaywada	56	2356.00	3764.00	0.000	8.900
Mahanadi	Rajim	Tikarpara	20	3466.00	11930.00	0.000	120.000
Subarnarekha	Muri	Ghatsila	4	325.00	3990.00	0.159	1.200

Source : Central Water Commission(Hydrological Data Directorate).

* : Figures of Mahi River relate to the year 1993-94.

\# : Figures of Tapi River related to the Year 1995-96.

@ : Figures of Krishna River relate to the year 1995-96.

TABLE 6.1.8 : STATE-WISE DETAILS OF INLAND WATER RESOURCES OF VARIOUS TYPES, 1993

(lakh hectare)

S. No.	State/UT	Rivers & C. (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 Pradesh	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 Islands	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

Source : Fisheries Division, Department of Agriculture & Cooperation, Ministry of Agriculture.

N.A. : Not Available.

(P) : Provisional.

Neg. : Negligible.

Cow Ray - Bay of Bengal.

TABLE 6.1.9 : TOTAL LENGTH OF IMPORTANT RIVERS - BY STATE

(in Km.)

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
5.	Karnataka (c)	Total	1983
		Cauvery	270
		Tungabhadra	375
		Krishna	375
		Malaprabha	230
		Sharavathi	250
		Others	483

TABLE 6.1.9 : TOTAL LENGTH OF IMPORTANT RIVERS - BY STATE—*Concld.*

(in Km.)

S. No.	State	River	Total Length
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

Source : Transport Research Division. Ministry of Surface Transport.

(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.

TABLE 6.1.10 : GROUND WATER RESOURCE POTENTIAL AS PER BASINS (PRORATA BASIS)

S.No.	BASIN	Total Replenish-able Gro-und Water Resource (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 Baitami	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	Krishna 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 6.1.11 : STATE-WISE GROUND WATER RESOURCES

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 Cubic 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.

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TABLE 6.1.19 : MINIMUM & MAXIMUM OF OBSERVED VALUES OF WATER QUALITY PARAMETERS AT CWC SITES ON WEST FLOWING RIVERS (JUNE 1993 TO MAY 1994)

S. No.	Name of the Site	Name of the River/ Stream	pH Value		Specific Conductance in micromhos/cm at 25°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	7.60	8.20	176	465	0.38	1.45	1.01	0.36	0.00	0.01	0.72	40.94	0.48	115.97
2	Kamalpur	Banas	8.00	8.20	250	333	0.49	0.84	0.68	0.27	0.00	0.01	0.80	28.47	0.10	119.96
3	Chitrasani	Banas	7.90	8.10	425	633	1.81	2.67	2.42	0.48	0.01	0.03	1.04	51.91	0.59	144.90
4	Aburoad	Banas	7.80	8.10	442	1372	0.90	4.21	4.11	0.73	0.02	0.05	1.60	60.35	1.37	191.94
5	Ganod	Bhadar	7.60	8.20	450	1771	1.67	7.42	6.48	1.30	0.01	0.03	1.60	77.09	1.50	191.94
6	Pingalwada	Bhadar	7.40	8.20	261	2021	0.67	9.37	8.39	2.45	0.02	0.08	1.20	77.20	2.87	175.94
7	Motinaroli	Kim	7.60	8.20	325	1400	0.94	7.43	6.03	0.98	0.01	0.02	1.04	75.96	2.42	148.61
8	Khanpur	Mahi	7.80	8.20	229	874	0.54	2.26	1.63	0.55	0.01	0.02	0.80	49.86	0.63	128.29
9	Padardibadi	Mahi	7.70	8.20	233	653	0.59	1.61	1.13	0.40	0.01	0.01	0.80	41.76	0.49	127.97
10	Rangeli	Sovr.	7.70	8.20	292	673	0.50	2.15	1.63	0.43	0.01	0.01	0.80	48.00	0.52	128.04
11	Mataji	Mahi	7.70	8.20	198	412	0.38	0.96	0.73	0.33	0.00	0.01	0.64	32.32	0.25	116.08
12	Mahuwa	Purna	7.70	8.20	192	789	0.38	2.83	2.25	0.43	0.00	0.02	0.96	54.39	0.72	135.97
13	Nadhoi	Sabarmati	5.50	8.00	225	4542	0.58	12.21	14.54	8.00	0.02	0.18	2.50	80.20	2.38	390.33
14	Wautha	Sabarmati	5.80	8.10	893	4212	3.95	12.78	17.69	6.84	0.02	0.22	3.46	77.03	1.94	442.32
15	Derol Bridge	Sabarmati	7.60	8.20	237	950	0.50	2.21	1.69	0.60	0.01	0.02	1.01	48.09	0.65	142.60
16	Lowara	Shetrunji	7.50	8.20	280	1624	0.84	6.97	6.14	2.25	0.01	0.04	1.20	70.97	0.63	165.22
17	Ghala	Tapi	7.60	8.20	175	336	0.36	0.78	0.56	0.28	0.00	0.01	0.64	27.88	0.70	108.09
18	Sarangkheda	Tapi	7.80	8.00	164	515	0.28	1.89	1.30	0.28	0.00	0.02	0.72	46.61	0.61	115.97
19	Gldhada	Tapi	7.80	8.20	184	485	0.36	1.37	0.96	0.47	0.00	0.02	0.72	38.41	0.25	115.97
20	Morane	Tapi	7.90	8.20	343	580	0.77	1.75	1.24	0.44	0.00	0.02	0.80	43.84	0.49	119.96

TABLE 6.1.18 : WATER QUALITY OF YAMUNA RIVER (DELHI STRETCH) IN RESPECT OF SELECTIVE PHYSICO-CHEMICAL PARAMETERS BETWEEN APRIL, 1998 TO MARCH, 1999

Parameters	Value	Palla (Upstream Wazirabad)	Nizamudddin		Agra Canal (Originated from Okhla Barrage)	
			Midstream sample	Quarterstream sample	Midstream sample	Quarterstream sample
pH (units)	Minimum	7.00	7.33	7.21	7.14	7.61
	Maximum	8.22	8.07	8.06	8.15	8.25
	Average	7.91	7.77	7.67	7.74	7.79
Dissolved Oxygen (mg/l)	Minimum	5.00	0.00	0.00	0.00	0.00
	Maximum	10.50	6.00	6.00	5.80	6.00
	Average	7.41	3.40	3.32	2.12	2.07
BOD (mg/l)	Minimum	1.00	2.00	2.00	2.00	2.00
	Maximum	2.00	11.00	12.00	12.00	16.00
	Average	1.18	4.92	5.08	4.91	5.09
Faecal coliforms Nos./ 100 ml	Minimum	55	810	870	700	700
	Maximum	750	262000	270000	174000	188000
	Average	251	50185	50716	47049	50253
Total coliforms Nos./ 100 ml	Minimum	800	5700	5700	6100	6200
	Maximum	61000	544000	570000	474000	502000
	Average	9604	126508	127667	131955	139482
COD (mg/l)	Minimum	4.00	8.00	9.00	13.00	10.00
	Maximum	20.00	67.80	69.00	70.00	68.00
	Average	11.64	81.00	27.75	33.36	35.18
Ammonical Nitrogen (mg/l)	Minimum	0.01	0.01	11.01	0.06	0.02
	Maximum	0.20	10.37	11.21	8.52	11.21
	Average	0.10	3.07	3.83	3.66	4.59

Source : Central Pollution Control Board

TABLE 6.1.12 : WATER REQUIREMENT IN DIFFERENT YEAR

(IN BCM)

Sector	Year		
	2000	2025	2050
Domestic	42	73	102
Irrigation	541	910	1072
Industry	8	22	63
Energy	2	15	130
Others	41	72	80
Total	634	1092	1447

Source : Central Water Commission (Basin Planning Directorate)

TABLE 6.1.13 : 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) Barak & 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
	Brahmani	Ranchi (Bihar)	799	39033
	hanadi	Nazri Town (Madhya Pradesh)	851	141589
		Nasik (Maharashtra)	1465	312812
		Mahabaleshwar (Maharashtra)	1401	258948
		Kolar (Karnataka)	597	55213
		Coorg (Karnataka)	800	81155
				2528084

nission, Reassessment of Water Resources Potential of India,1993

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Table 6.1.14 : 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 c 4 Biochemical Oxygen Dema 20°C 3mg/l or less.
Propagation of Wild life less	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
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 (1996 & 1997) Central Pollution Control Board

The water quality at any location is determined as the one which is
80% of time by all the criteria parameters. To further elucidate on t
80% of the time DO, pH were in the range specified for class A, BO
coliforms for class C, then the existing status is determined as C.

TABLE 6.1.15 : BIOLOGICAL WATER QUALITY CRITERIA (BWQC)

S. No.	Taxonomic Groups	Range of saprobic score (BMWP)	Range of Diversity score	Water Diversity Characteristics	Water Quality class	Indicator colour
1	Ephemeroptera, Plecoptera, 7 Trichoptera, Hemiptera, Diptera	and more	0.2 - 1	Clean	A	Blue
2	Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Planaria, Odonata, Diptera	6 - 7	0.5 - 1	Slight Pollution	B	Light Blue
3	Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Odonata, Crustacea, Mollusca, Polychaeta, Coleoptera, Diptera, Hirudinea, Oligochaeta	3 - 6	0.3 - 0.9	Moderate Pollution	C	Green
4	Hemiptera, Mollusca, Coleoptera, Diptera, Oligochaeta	2 - 5	0.4 & less	Heavy Pollution	D	Orange
5	Diptera, Oligochaeta, No animal	0 - 2	0 - 0.2	Severe Pollution	E	Red

Source : Central Pollution Control Board

TABLE 6.1.16 : PHYSICO - CHEMICAL AND BIOLOGICAL WATER QUALITY OF POLLUTED STRETCH OF RIVER YAMUNA AND AGRA CANAL

	Location	Water Quality Class		Water Quality
		Physico - Chemical (PWQC)	Biological (BWQC)	(Biological)
7				
8	Ma (River Yamuna)	E	E	Severe Pollution
9	Godavari Agra Canal	E	E	Severe Pollution
10	Krishna let at Agra Canal	E	E	Severe Pollution
11	Pennar trol Board			
12	Cauvery ver Plant			
	Total			

Source: Central Water Comr

* : As in Indian Territor

TABLE 6.1.17 : WASTE WATER GENERATION, COLLECTION, TREATMENT IN METRO CITIES : STATUS

S. No.	Name of Metro City	Total Population	Municipal Population	Volume of Waste Water Generated (mld)			Waste Water Collected		Capacity (mld)	Treatment		Mode of Disposal
				Domestic	Industrial	Total	Volume (mld)	%		Prim.	Secondary	
1	Ahmedabad	3312216	2876710	520.0	36.0	556.0	445.0	80.0	430.0	Y	Y	Sabarmati river
2	Bangalore	4130288	4130288	375.0	25.0	400.0	300.0	75.0	290.0	Y	Y	V. Valley, Ksc Valley
3	Bhopal	1062771	1062771	189.3	—	189.3	94.6	50.0	87.0	Y	Y	Agriculture
4	Bombay	12596243	12288519	2228.1	227.9	2456.0	2210.0	90.0	109.0	Y	Y	Sea
5	Calcutta	11021918	9643211	1383.8	48.4	1432.2	1074.9	75.1	—	—	—	Hughly river/ Fish Farm
6	Coimbatore	1100746	816321	60.0	—	60.0	45.0	75.0	—	—	—	Nayal river, Irrigation
7	Delhi	8419084	8419084	1270.0	—	1270.0	1016.0	80.0	981.0	Y	Y	Agriculture, Yamuna River
8	Hyderabad	4344437	4098734	348.3	25.0	373.3	299.0	80.1	115.0	Y	—	River, Irrigation
9	Indore	1109056	1091674	145.0	—	145.0	116.0	80.0	14.0	Y	—	Khan River, Irrigation
10	Jaipur	1518235	1458483	220.0	—	220.0	165.0	75.0	27.0	Y	Y	Agriculture
11	Kanpur	2029889	1874409	200.0	—	200.0	150.0	75.0	41.0	Y	Y	Ganga, Sewage Farm
12	Kochi	1140605	670009	75.0	—	75.0	45.0	60.0	—	—	—	Cochin Back waters
13	Lucknow	1669204	1619115	106.0	—	106.0	80.0	75.5	—	—	—	Gomati River
14	Ludhiana	1042740	1042740	94.4	—	94.4	47.0	49.8	—	—	—	Agriculture
15	Madras	5421985	4752974	276.0	—	276.0	257.0	93.1	257.0	Y	Y	Agriculture, Sea
16	Madurai	1085914	940989	48.0	—	48.0	33.6	70.0	—	—	—	Agriculture
17	Nagpur	1664006	1624752	204.8	—	204.8	163.0	79.6	45.0	Y	Y	Agriculture
18	Patna	1099647	917243	219.0	—	219.0	164.0	74.9	105.0	Y	N	River, Fishries
19	Pune	2493987	2244196	432.0	—	432.0	367.0	85.0	170.0	Y	Y	River
20	Surat	1518950	1498817	140.0	—	140.0	112.0	80.0	70.0	Y	-	Garden/Creek
21	Vadodara	1126824	1031346	120.0	20.0	140.0	105.0	75.0	81.0	Y	Y	river, Agriculture
22	Varanasi	1030863	1030863	170.0	—	170.0	127.0	74.7	101.0	Y	Y	Ganga, Agriculture
23	Vishakhapatnam	1057118	752037	68.0	—	68.0	55.0	80.9	—	—	—	—
	Total	70996726	65885285	8892.7	382.3	9275.0	7471.1	80.6	2923.0			

Source : Central Pollution control Board

Y = Yes N = No

TABLE 6.1.19 : MINIMUM & MAXIMUM OF OBSERVED VALUES OF WATER QUALITY PARAMETERS AT CWC SITES ON WEST FLOWING RIVERS (JUNE 1993 TO MAY 1994)—*Concld.*

S. No.	Name of the Site	Name of the River/ Stream	pH Value		Specific Conductance in micromhos/cm at 25°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)							
21	Malkheda	Tapi	7.90	8.10	219	492	0.44	1.45	1.07	0.41	0.01	0.02	0.72	39.77	0.30	115.97
22	Sankheda	Tapi	7.50	8.20	164	507	0.28	1.45	1.07	0.48	0.01	0.02	0.72	41.23	0.38	115.97
23	Dapuri	Tapi	7.50	8.20	247	547	0.53	1.75	1.24	0.56	0.01	0.03	0.72	43.84	0.39	119.99
24	Yerli	Tapi	7.60	8.20	183	1063	0.46	4.47	3.61	0.59	0.01	0.03	0.96	65.32	1.48	135.94
25	Gopalkhera	Tapi	7.70	8.20	246	1048	0.70	4.64	1.90	0.71	0.01	0.02	1.12	65.53	1.62	143.84
26	Lakhpuri	Tapi	7.70	8.10	308	1243	0.94	5.07	3.94	0.59	0.01	0.04	1.04	67.50	2.01	143.95
27	Burhanpur	Tapi	7.70	8.20	175	933	0.36	3.82	2.99	0.56	0.01	0.04	1.03	61.75	1.17	134.77
28	Dedtali	Tapi	7.10	8.10	170	1183	0.27	4.68	3.38	0.71	0.01	0.02	0.88	67.55	1.49	135.94
29	Durvesh	Vaitarna	7.70	8.10	206	270	0.36	0.78	0.56	0.20	0.00	0.01	0.56	27.88	0.16	104.06

Source : Central Water Commission (Hydrological Data Directorate)

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

TABLE 6.1.20 : MINIMUM & MAXIMUM OF OBSERVED VALUES OF WATER QUALITY PARAMETERS AT CWC SITES ON EAST FLOWING RIVERS (JUNE 1995 TO MAY 1996)

S. No.	Name of the Site	Name of the River/ Stream	pH Value		Specific Conductance in micromhos/cm at 25°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.	Tikarapara	Mahanadi	7.10	8.49	140	227	0.26	0.65	0.381	0.19	0.101	0.011	0.560	29.32	0.80	84.07
2.	Kantamal	Tel	7.19	8.21	99	234	0.33	0.67	0.530	0.18	0.770	0.013	1.000	29.90	0.55	105.08
3.	Salebhata	Ong	7.61	8.04	200	487	0.60	1.14	0.500	0.14	0.010	0.024	1.250	34.57	0.80	175.14
4.	Sundergarh	Ib	7.38	8.12	130	158	0.26	0.59	0.270	0.10	0.015	0.005	0.700	27.85	0.30	70.06
5.	Kurubhanta	Mand	6.36	8.01	82	192	0.10	0.32	0.300	0.51	0.102	0.001	0.900	17.19	0.18	75.06
6.	Basantpur	Mahanadi	7.53	8.21	103	260	0.36	0.70	0.435	0.26	0.097	0.014	0.640	31.83	0.18	104.08
7.	Bamnidhi	Hasdeo	7.28	8.10	91	159	0.17	0.73	0.321	0.30	0.098	0.015	0.480	32.98	0.03	60.05
8.	Rampur	Jonk	7.42	7.96	123	277	0.33	0.85	0.400	0.11	0.046	0.004	0.800	32.11	0.61	125.10
9.	Jondhra	Seonath	7.22	8.10	480	518	0.92	1.83	1.690	0.71	0.244	0.001	2.400	40.17	0.64	365.29
10.	Andhiyarkore	Hamp	7.20	8.32	220	860	0.61	2.66	0.610	2.44	0.158	0.005	3.450	44.71	1.48	340.27
11.	Simga	Seonath	7.29	8.28	183	458	0.42	1.58	0.710	1.04	0.086	0.007	1.400	38.61	1.10	162.63
12.	Rajim	Mahanadi	7.43	8.02	92	263	0.12	0.76	0.330	0.28	0.196	0.006	0.800	30.72	0.30	120.10
13.	Baronda	Pairi	6.94	8.12	76	163	0.16	0.40	0.400	0.15	0.046	0.004	0.800	22.92	0.24	75.06
14.	Jenapur	Brahmani	7.51	8.40	88	145	0.31	0.53	0.217	0.26	0.155	0.013	0.400	27.56	0.01	48.04
15.	Telechar	Brahmani	7.62	8.26	81	310	0.30	0.65	0.536	0.81	0.138	0.019	0.880	27.66	0.06	116.09
16.	Gomlai	Brahmani	7.63	8.22	70	204	0.32	0.56	0.435	0.33	0.670	0.024	0.560	31.43	0.10	76.06
17.	Jaraikela	Koel	7.74	8.20	83	198	0.31	0.54	0.965	0.17	0.256	0.011	0.960	25.35	0.20	84.07
18.	Anandpur	Baitarani	7.10	8.26	106	178	0.27	0.71	0.702	0.23	0.158	0.082	0.320	34.85	0.21	60.05
19.	Ghatsila	Subaranrekha	7.72	8.50	145	390	0.36	1.27	0.761	1.79	0.547	0.325	0.880	36.27	0.10	128.10
20.	Jamshedpur	Subaranrekha	7.70	10.70	183	610	0.41	1.42	0.707	0.70	0.122	0.130	1.200	33.11	0.77	188.15
21.	Adityapur	Karkai	7.81	8.66	141	820	0.41	1.02	0.653	0.31	0.175	0.014	0.800	32.59	0.24	104.08
22.	Muri	Subaranrekha	7.47	8.63	133	273	0.51	1.76	0.857	0.28	0.113	0.025	0.480	50.54	0.46	92.07
23.	Kashinagar	Vamsadhara	7.35	8.15	140	520	0.44	1.11	1.073	0.34	0.188	0.200	1.281	33.23	0.45	176.19
24.	Tilga	Sankh	7.66	8.21	46	110	0.36	0.60	0.324	0.18	0.071	0.024	0.240	39.25	0.13	36.08
25.	Bolani	Brahmani	7.63	8.20	95	247	0.31	0.57	0.375	0.42	0.696	0.014	0.720	25.38	0.07	100.08

Source : Central Water Commission (Information System Directorate)

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

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Table 6.1.21 : 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, Coleroon, Shimsha	17	17	34
Ganga	Barakar, Damodar, Gandak, Ghaghra, Kshipra, Kalinadi, Mandakini, Ramganga, Rihand, Rupanarayan, Saryu, Sai, Son, Gomati, Tons, Yamuna, Betwa, Banas, Chambal, Hindon, Khan, Alaknanda, Bhagirathi, Yamuna, Rapti	27	71	98
Godavari	Kalu, Manjera, Maner, Panchganga, Ulhas, Wainganga, Wardha, Pench	11	11	22
Indus	Beas, Chenab, Jhelum, Largi, Parvati(HP), Ravi, Satluj, Tawi		40	40
Krishna	Bhandra, Bhima, Nira, Ghatprabha, Hemawati, Malprabha, Muneru, Musi, Palleru, Tungha, Tungha-bhadra	13	29	42
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, Shedi	8	2	10
Tapi	Girna	10	2	12
Penner		4	..	4
Subernarekha		4	..	4
West Flowing Medium Rivers	Ambika, Bhada, Kali (W), Mandovi, Pamba, Periyar	11	..	11
East Flowing Medium Rivers	Nagavalli, Palar, Rushikulya, Tambiraparani	11	..	11
Minor Rivers	Achankoli, Chalakudy, Damanganga, Ghaggar, Kallad, Manimala, Mindhola, Parvati(MP), Borak, Iril, Imphal, Umtrew, Khari, Kolak, Bhatsa, Kundalika, Patalganga, Zuari, Chaliyar, Karmana, Mauthupuzha, Meenachil, Amlakhadi, Kali (Kar), Vamanpuram, Kharkhla	42	..	42

Source : Water Quality - Status & Statistics (1996 & 1997)
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 6.2.2 : 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, temperature, 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	increases 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.

TABLE 6.2.6 : CRITERIA FOR CLASSIFICATION OF INLAND SURFACE WATER

Parameter	Maximum/ Minimum	Drinking water without conventional treatment but after disinfection	Outdoor bathing organized	Drinking water with conventional treatment followed by disinfection	Propagation of wildlife and fisheries	Irrigation, Industrial, cooling etc.
Dissolved oxygen (mg/litre)	Minimum	6	5	4	4	-
Biological oxygen demand (mg/letre)	Minimum	2	3	3	-	-
Total coliform bacteria (most probable number per 100 millilitres)	Maximum	50	500	5000	-	-
Total dissolved solids (mg/litre)	Maximum	500	-	1500	.	2100
Chloride as chlorine (mg/litre)		250	-	600	-	500
Colour (hazen)	Maximum	10	300	300	-	-
Sodium absorption ratio	Maximum	-	-	-	-	26
Boron (mg/litre)	Maximum	-	-	-	-	2
Sulphates (mg/litre)	Maximum	400	-	400	-	1000
Nitrates (mg/litre)	Maximum	20	-	50	-	-
Free ammonia as nitrogen (mg/litre)	Maximum	-	-	-	12	-
Conductivity at 25°C(µs/cm)	Maximum	-	-	-	1	2.25
PH	-	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.0-8.0
Arsenic (mg/litre)	Maximum	0.05	0.2	0.2	-	-
Iron (mg/litre)	Maximum	0.3	-	50	-	-
Fluorides (mg/litre)	Mximum	1.5	1.5	1	-	-
Lead (mg/litre)	Maximum	0.1	-	0.1	-	-
copper (mg/litre)	Maximum	1.5	-	1.5	-	.
Zinc (mg/litre)	Maximum	15	-	15	~	~

Source : Teri Energy Data Directory Yearbook, 2000-2001

CHAPTER SEVEN

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 declined much faster 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 rate and life expectancy. Polluted air and poor and unhygienic conditions in settlements contributing to reduction in life expectancy and increase in 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 all these factors and to avoid risks. Larger population leads to more poverty and worsens the environment, creating a vicious cycle.

HOUSING AND BASIC SERVICES

We do not need food only but along with the food we also need potable drinking water, adequate system for disposal of excreta, good sanitation and personal hygiene to reduce prevalence of morbidity. Several studies carried out in our villages confirm that diarrhea and respiratory diseases 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 to fight the illness. It is this negative correlation which Japan used to formulate its 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 .

URBANISATION

Environment has also been affected badly due to rapid growth of urbanization. Urban population in India is growing at an annual rate of 3.5 % 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.

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SOLID WASTE AND HAZARDOUS MATERIAL MANANGEMENT

Due to rapid growth of urbanization, there is substantial increase in generation of solid waste in both absolute and per capita terms. Surveys have been conducted to assess for solid waste generation, collection, treatment and disposal in 291 Class I cities and 345 Class II cities. It has been indicated that very little amount of waste generated is treated. The problems in management of wastes relate to its collection, handling, transport and disposal. Segregation of solid wastes is not uncommon in India as much of recycling work is being done either by ragpickers or non Governmental agencies in few areas. Proper sanitary landfilling sites need to be developed which are effective in keeping the surface and ground water free from leachates.

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 65-70% methane gas which is a green house gas have a global warming potential 34 times more than that of Carbon Dioxide. Therefore, development of suitable technologies for utilization of wastes is essential to minimize adverse health and environment consequences. Comprehensive guidelines are available with Central Pollution Control Board for Toxic Waste Management including hospital wastes.

STUDY ON SOLID WASTES IN DELHI

As per the study conducted in 1999, to generate data on Solid wastes produced in Delhi, it was found that the average daily generation of municipal solid wastes in Delhi is 5327 tons. Its physical analysis revealed that the wastes consist of about 47% of biodegradable component. The recyclable components include paper and cardboard (6.7%), plastics(4.17%) and metal (1%). Total revenues to be earned through selling out these recyclable components will be of the order of crores of rupees. Data revealed that a large amount of Municipal Solid Waste generated can be recycled and reused. Technique and technologies for the same are available. It is also economically attractive and commonly practised by many countries in the world.

PLASTICS WASTE MANAGEMENT

Use of plastics have grown manifolds all over the world as it has many advantages. They are light, easy to mould, durable and easy to adopt to different user requirements. However plastics are difficult to destroy and are classified as non-biodegradable. On the other hand it is easy to recycle plastics.

In the Indian context it is seen that the growth of the plastic industries is phenomenal. Polymer demand in India has consistently recorded double digit growth rates, trebling every 10 years. India's per capita consumption of 1.6 kg of plastics is expected to rise to around 4 Kg by the year 2000. However as compared to the world's statistics of per capita consumption of plastics it is still far less. In the year 1998 the per capita consumption of Western Europe was 60 Kg, that of Japan was 70 Kg. and of USA was 78 Kg as against 1.6 Kg of India. Also about 60% of the plastic wastes generated in India are recycled which is the highest in the world. However the remaining 40 % of the plastic wastes remains uncollected, unsegregated, strewn on the ground, littered around in open drains or in unmanaged garbage dumps. The collection of such solid waste including the one recycled three or even four times earlier, is not only uneconomical for recovery of material but also unhygienic and undermines the environmental benefits of materials recycling. These indiscriminately disposed solid plastic wastes are of concern in view of causing chokage of municipal sewers , blocking of the storm water run-offs in drains particularly in hilly areas, causing deaths to many animals like cows which feed on the garbage food thrown in polythene bags.

TABLE 7.1.1 : POPULATION TOTALS - INDIA AND STATES

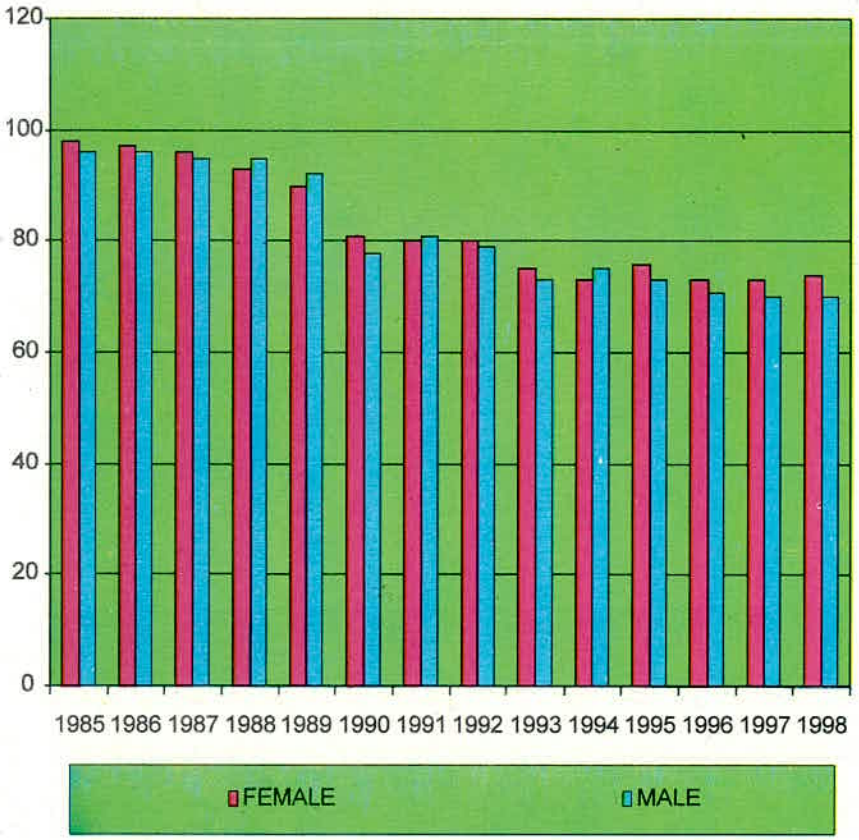
STATES/U.TS.	1961		1971		1981	
	Male	Female	Male	Female	Male	Female
Andhra Pradesh	18161671	17821776	22008663	21494045	27109616	26441410
Arunachal Pradesh	177680	158878	251231	216280	339322	292517
Assam@	5798376	5038953	7714240	6910912	9444037	8597211
Bihar	23297343	23150114	28846944	27506425	35930560	33984174
Goa	285625	304372	401362	393758	510152	497597
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
Daman & Diu	16909	19761	29852	32799	38298	40683
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.

@ : The 1981 figures of population for Assam are interpolated.

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

SEX-WISE



SECTOR-WISE

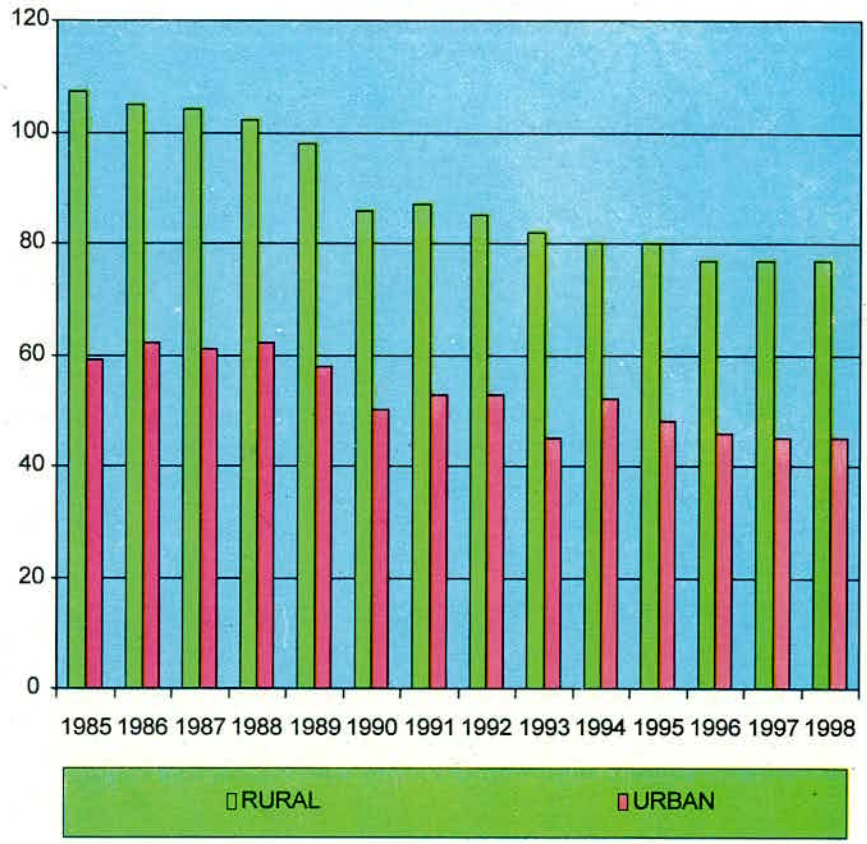


TABLE 7.1.3 : EXPECTATION OF LIFE AT BIRTH

(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
1992-96*	61.4	60.1	60.7
1993-97*	61.8	60.4	61.1

Source : Office of the 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

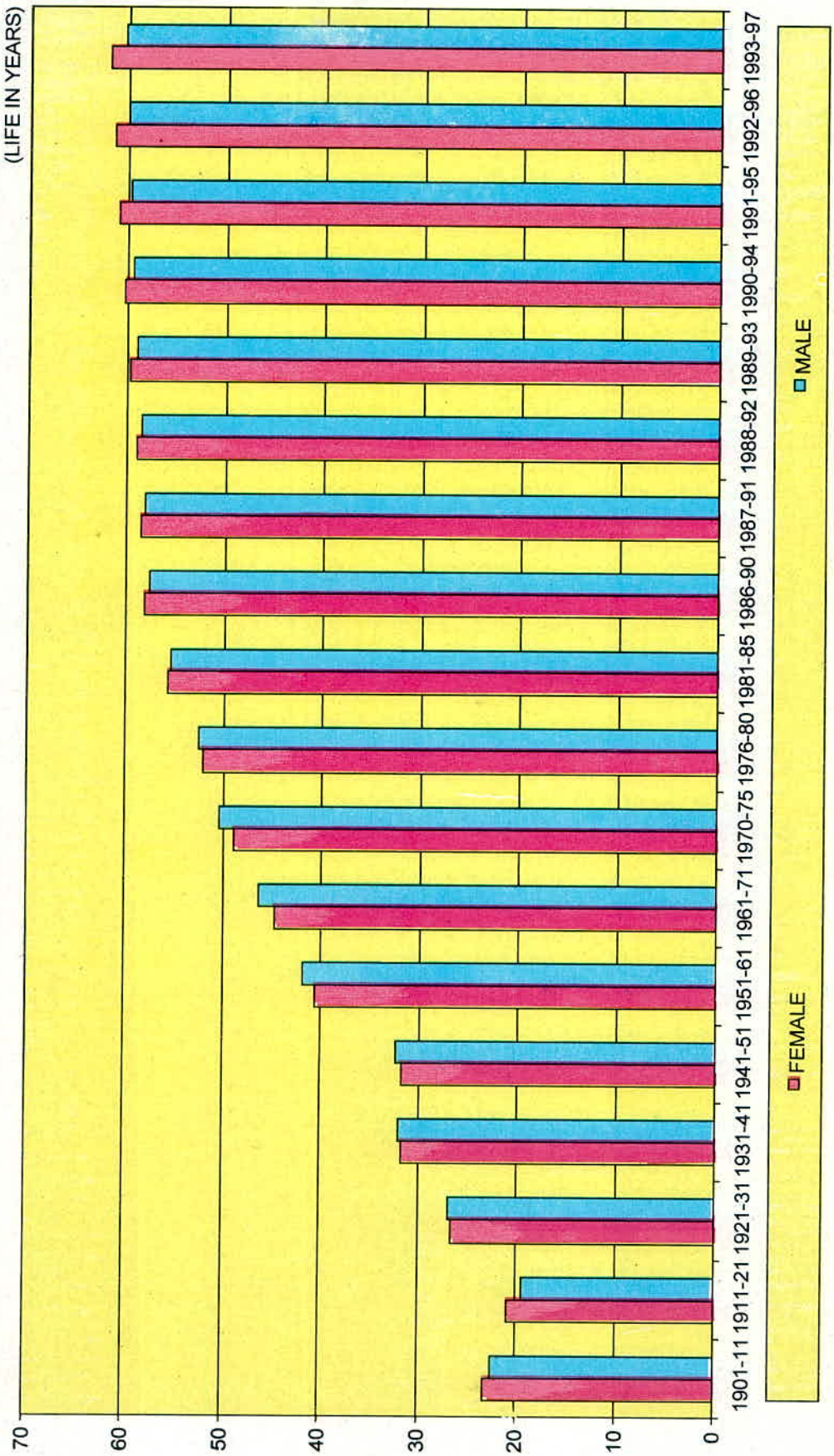


TABLE 7.1.4 : STATE-WISE PERCENTAGE OF POPULATION BELOW THE POVERTY LINE (MODIFIED EXPERT GROUP)

States	Rural				
	1973-74	1977-78	1983	1987-88	1993-94
Andhra Pradesh	48.41	38.11	26.53	20.92	15.92
Arunachal Pradesh	52.67	59.82	42.60	39.35	45.01
Assam	52.67	59.82	42.60	39.35	45.01
Bihar	62.99	63.25	64.37	52.63	58.21
Goa	46.85	37.64	14.81	17.64	5.34
Gujarat	46.35	41.76	29.80	28.67	22.18
Haryana	34.23	27.73	20.56	16.22	28.02
Himachal Pradesh	27.42	33.49	17.00	16.28	30.34
Jammu & Kashmir	45.51	42.86	26.04	25.70	30.34
Karnataka	55.14	48.18	36.33	32.82	29.88
Kerala	59.19	51.48	39.03	29.10	25.76
Madhya Pradesh	62.66	62.52	48.90	41.92	40.64
Maharashtra	57.71	63.97	45.23	40.78	37.93
Manipur	52.67	59.82	42.60	39.35	45.01
Meghalya	52.67	59.82	42.60	39.35	45.01
Mizoram	52.67	59.82	42.60	39.35	45.01
Nagaland	52.67	59.82	42.60	39.35	45.01
Orissa	67.28	72.38	67.53	57.64	49.72
Punjab	28.21	16.37	13.20	12.60	11.95
Rajasthan	44.76	35.89	33.50	33.21	26.46
Sikkim	52.67	59.82	42.60	39.35	45.01
Tamil Nadu	57.43	57.68	53.99	45.80	32.48
Tripura	52.67	59.82	42.60	39.35	45.01
Uttar Pradesh	56.53	47.60	46.45	41.10	42.28
West Bengal	73.16	68.34	63.05	48.30	40.80
Delhi	24.44	30.19	7.66	1.29	1.90
Andman& Nicobar Islands	57.43	57.68	53.99	45.80	32.48
Chandigarh	27.96	27.32	23.79	14.67	11.35
Dadra & Nagar Haveli	46.85	37.64	14.81	67.11	51.95
Lakshadweep	59.19	51.48	39.03	29.10	25.76
Pondicherry	57.43	57.68	53.99	45.80	32.48
Daman & Diu	NA	NA	NA	NA	5.34
All India	56.44	53.07	45.65	39.09	37.27

Source : Planning Commission Estimates.

Notes : 1. Poverty Ratio of Assam is used for Sikkim, Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Nagaland, and Tripura.

2. Poverty Ratio of Tamilnadu is used for Pondicherry and A & N Islands.
3. Poverty Ratio of Kerala is used for Lakshadweep.
4. Poverty Ratio of Goa is used for Daman & Diu.
5. Urban Poverty Ratio of Punjab used for both rural and urban Poverty of Chandigarh.
6. Poverty Line of Maharashtra and expenditure distribution of Goa is used to estimate Poverty Ratio of Goa.
7. Poverty Line of Maharashtra and expenditure distribution of Dadra & Nagar Haveli is used to estimate Poverty Ratio of Dadra & Nagar Haveli.
8. Poverty Ratio of Himachal Pradesh is used for Jammu & Kashmir for 1993-94.

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TABLE 7.1.4 : STATE-WISE PERCENTAGE OF POPULATION BELOW THE POVERTY LINE (MODIFIED EXPERT GROUP)—*Contd.*

States	Urban				
	1973-74	1977-78	1983	1987-88	1993-94
Andhra Pradesh	50.61	43.55	36.30	40.11	38.33
Arunachal Pradesh	36.92	32.71	21.73	9.94	7.73
Assam	36.92	32.71	21.73	9.94	7.73
Bihar	52.96	48.76	47.33	48.73	34.50
Goa	37.69	36.31	27.00	35.48	27.03
Gujarat	52.57	40.02	39.14	37.26	27.89
Haryana	40.18	36.57	24.15	17.99	16.38
Himachal Pradesh	13.17	19.44	9.43	6.29	9.18
Jammu & Kashmir	21.32	23.71	17.76	17.47	9.18
Karnataka	52.53	50.36	42.82	48.42	40.14
Kerala	62.74	55.62	45.68	40.33	24.55
Madhya Pradesh	57.65	58.66	53.06	47.09	48.38
Maharashtra	43.87	40.09	40.26	39.78	35.15
Manipur	36.92	32.71	21.73	9.94	7.73
Meghalya	36.92	32.71	21.73	9.94	7.73
Mizoram	36.92	32.71	21.73	9.94	7.73
Nagaland	36.92	32.71	21.73	9.94	7.73
Orissa	55.62	50.92	49.15	41.63	41.64
Punjab	27.96	27.32	23.79	14.67	11.35
Rajasthan	52.13	43.53	37.94	41.92	30.49
Sikkim	36.92	32.71	21.73	9.94	7.73
Tamil Nadu	49.40	48.69	46.96	38.64	39.77
Tripura	36.92	32.71	21.73	9.94	7.73
Uttar Pradesh	60.09	56.23	49.82	42.96	35.39
West Bengal	34.67	38.20	32.32	35.08	22.41
Delhi	52.23	33.51	27.89	13.56	16.03
Andman & Nicobar Islands	49.40	48.69	46.96	38.64	39.77
Chandigarh	27.96	27.32	23.79	14.67	11.35
Dadra & Nagar Haveli	37.69	36.31	27.00	-	39.93
Lakshadweep	62.74	55.62	45.68	40.33	24.55
Pondicherry	49.40	48.69	46.96	38.64	39.77
Daman & Diu	NA	NA	NA	NA	27.03
All India	49.01	45.24	40.79	38.20	32.36

Source : Planning Commission Estimates.

Notes : 1. Poverty Ratio of Assam is used for Sikkim, Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Nagaland, and Tripura.
2. Poverty Ratio of Tamilnadu is used for Pondicherry and A & N Islands.
3. Poverty ratio of Kerala is used for Lakshadweep.
4. Poverty Ratio of Goa is used for Daman & Diu.
5. Urban Poverty Ratio of Punjab used for both rural and urban Poverty of Chandigarh.
6. Poverty Line of Maharashtra and expenditure distribution of Goa is used to estimate Poverty Ratio of Goa.
7. Poverty Line of Maharashtra and expenditure distribution of Dadra & Nagar Haveli is used to estimate Poverty Ratio of Dadra & Nagar haveli.
8. Poverty Ratio of Himachal Pradesh is used for Jammu & Kashmir for 1993-94.

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TABLE 7.1.4 : STATE-WISE PERCENTAGE OF POPULATION BELOW THE POVERTY LINE (MODIFIED EXPERT GROUP)—*Concld.*

States	Combined				
	1973-74	1977-78	1983	1987-88	1993-94
Andhra Pradesh	48.86	39.31	28.91	25.86	22.19
Arunachal Pradesh	51.93	58.32	40.68	36.22	39.35
Assam	51.21	57.15	40.47	36.21	40.86
Bihar	61.91	61.55	62.22	52.13	54.96
Goa	44.26	37.23	18.90	24.52	14.92
Gujarat	48.15	41.23	32.79	31.54	24.21
Haryana	35.36	29.55	21.37	16.64	25.05
Himachal Pradesh	26.39	32.45	16.40	15.45	28.44
Jammu & Kashmir	40.83	38.97	24.24	23.82	25.17
Karnataka	54.47	48.78	38.24	37.53	33.16
Kerala	59.79	52.22	40.42	31.79	25.43
Madhya Pradesh	61.78	61.78	49.78	43.07	42.52
Maharashtra	53.24	55.88	43.44	40.41	36.86
Manipur	49.96	53.72	37.02	31.35	33.78
Meghalya	50.20	55.19	38.81	33.92	37.92
Mizoram	50.32	54.38	36.00	27.52	25.66
Nagaland	50.81	56.04	39.25	34.43	37.92
Orissa	66.18	70.07	65.29	55.58	48.56
Punjab	28.15	19.27	16.18	13.20	11.77
Rajasthan	46.14	37.42	34.46	35.15	27.41
Sikkim	50.86	55.89	39.71	36.06	41.43
Tamil Nadu	54.94	54.79	51.66	43.39	35.03
Tripura	51.00	56.88	40.03	35.23	39.01
Uttar Pradesh	57.07	49.05	47.07	41.46	40.85
West Bengal	63.43	60.52	54.85	44.72	35.66
Delhi	49.61	33.23	26.22	12.41	14.69
Andman & Nicobar Islands	55.56	55.42	52.13	43.89	34.47
Chandigarh	27.96	27.32	23.79	14.67	11.35
Dadra & Nagar Haveli	46.55	37.20	15.67	67.11	50.84
Lakshadweep	59.68	52.79	42.36	34.95	25.04
Pondicherry	53.82	53.25	50.06	41.46	37.40
Daman & Diu	NA	NA	NA	NA	15.80
All India	54.88	51.32	44.48	38.86	35.97

Source : Planning Commission Estimates.

Notes : 1. Poverty Ratio of Assam is used for Sikkim, Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Nagaland, and Tripura.
2. Poverty Ratio of Tamilnadu is used for Pondicherry and A & N Islands.
3. Poverty ratio of Kerala is used for Lakshadweep.
4. Poverty Ratio of Goa is used for Daman & Diu.
5. Urban Poverty Ratio of Punjab used for both rural and urban poverty of Chandigarh.
6. Poverty Line of Maharashtra and expenditure distribution of Goa is used to estimate Poverty Ratio of Goa.
7. Poverty Line of Maharashtra and expenditure distribution of Dadra & Nagar Haveli is used to estimate Poverty Ratio of Dadra & Nagar haveli.
8. Poverty Ratio of Himachal Pradesh is used for Jammu & Kashmir for 1993-94.

TABLE 7.1.5 : PERCENTAGE DISTRIBUTION OF DEATHS BY MAJOR CAUSE GROUPS, INDIA (RURAL) 1991-96

S. No.	Code No.	Major Causes of Deaths	1991	1992	1993	1994	1995	1996
1	R	Symptoms, Signs and Abnormal Clinical findings not elsewhere mentioned	26.7	26.4	26.2	24.3	18.6	20.6
2	J	Deseases of the Respiratory System	14.2	14.4	14.4	15.1	16.6	17.8
3	A	Infectious and Parasitic Diseses	12.0	7.9	7.6	8.2	9.5	10.9
4	I	Diseases of Circulatory System	8.1	12.7	12.5	12.0	11.9	10.2
5	P	Conditions Originating in the Perinatal Period	9.3	8.9	10.0	9.0	9.2	7.9
6	X	With Venomous Animal contact	4.8	4.5	4.2	5.0	4.8	5.6
7	G	Inflamatory Diseases of Central Nervous System	4.4	5.0	4.7	5.0	6.0	5.5
8	B	Viral Infection	5.1	3.2	3.1	3.9	4.2	3.9
9	C	Neoplasm	3.1	4.9	4.2	4.4	4.7	3.6
10	D	Deseases of the blood and blood forming organs	3.0	2.9	3.1	3.0	3.0	3.4
11	V	External Causes of Mortality	1.9	2.1	2.1	2.2	2.4	2.1
12	K	Diseases of the Digestive system	1.5	1.4	1.4	1.6	1.6	2.0
13	T	Injuries Poisoning and other consequences of external causes	1.5	1.2	1.3	1.3	1.4	1.1
14	E	Metabolic Diseases	0.7	0.6	0.6	0.8	0.9	1.0
15	O	Preganancy Child Birth and Puerperium	1.0	0.5	0.5	0.6	0.7	0.8
16	N	Diseases of Genitourinary System	0.5	0.9	1.1	0.9	0.8	0.7
17	F	Mental and Behavioural Disorders	0.3	0.4	0.5	0.5	0.5	0.6
18	W	Other external causes of Accidental Injuries	0.5	0.3	0.6	0.4	0.5	0.5
19	Q	Congenital Malformations, Deformations and Abnormalities	0.4	0.4	0.5	0.3	0.3	0.4
		Other medically certified deaths	1.0	1.4	1.4	1.5	2.4	1.3
		Grand Total	100.0	100.0	100.0	100.0	100.0	100.0

Source : Office of the Registrar General, India.

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.

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	0.9	5.0
Rural	622812376	111591326	115907349	5.6	1.0	5.4

Source: Office of the Registrar General, 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	838583988	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: Office of the Registrar General, 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 NUMBER OF 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	118614803	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	78395	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	0.01			
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			

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

	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			
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	45.6	29.9	13.1	6.7	4.7	N			
1991	1080695	445250	343435	163275	81595	46945	195			
Rate	100.0	41.2	31.8	15.1	7.6	4.3	0.0			

Source : Office of the Registrar General, India

* Excluding Assam Excluding houseless and Institutional Households

\+ Excluding J& K Excluding Institutional households

Note : Unknown also includes households with no exclusive rooms

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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
Cochin	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 7.2.7 : 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. In spite of the efforts to contain the number of slum dwellers, it has been increasing fast which is causing tremendous pressure on urban basic services and infrastructure. The Slum population in the country as on 1991 was of the order of 463 lakh constituting nearly 21 per cent of the urban population. The distribution of urban population indicates the preponderance of slum dwellers in the 23 metropolitan cities of the country which accommodate about 26.6 per cent of the total population of these centres. The Sprouting of slums in urban areas is the direct outcome of better economic opportunities available in cities and towns.

TABLE 7.2.8 : ALL INDIA AND STATE-WISE SLUM POPULATION 1993-94 *

(In Million)

S.No.	Name of State/ U.T.s	Rural	Urban	Total
1	Andhra Pradesh	5.67	3.70	9.37
2	Arunachal Pradesh	—	—	—
3	Assam	0.02	0.10	0.12
4	Bihar	4.21	0.90	5.11
5	Goa	—	—	—
6	Gujarat	0.69	0.99	1.68
7	Haryana	0.21	0.58	0.79
8	Himachal Pradesh	—	0.02	0.02
9	Jammu & Kashmir	—	—	—
10	Karnataka	0.28	2.77	3.05
11	Kerala	0.08	0.12	0.20
12	Madhya Pradesh	0.21	1.41	1.62
13	Maharashtra	3.55	6.86	10.41
14	Manipur	—	—	—
15	Meghalaya	0.02	0.05	0.07
16	Mizoram	—	—	—
17	Nagaland	—	—	—
18	Orissa	1.43	0.66	—
19	Punjab	—	0.21	0.21
20	Rajasthan	—	0.43	0.43
21	Sikkim	—	0.01	0.01
22	Tamil Nadu	0.86	2.16	3.02
23	Tripura	0.01	—	0.01
24	Uttar Pradesh	0.87	1.16	2.03
25	West Bengal	0.30	3.70	4.00
26	Andaman & Nicobar Islands	—	—	—
27	Chandigarh	—	0.04	0.04
28	Dadra & Nagar Haveli	—	—	—
29	Daman and Diu	—	—	—
30	Delhi	—	2.03	2.03
31	Lakshadweep	—	—	—
32	Pondicherry	0.01	—	0.01
	All-India	18.42	27.90	44.23

Source : NSSO, 49th Round (Jan.-Jun 1993)

* : Estimates of Slum population have been arrived at by multiplying the estimated no. of households in slums to be estimated household size as given by NSSO on the basis of its 49th round (Jan.-Jun.1993) Survey.

TABLE 7.2.9 : STATE-WISE 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 State 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 7.2.10 : 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
		Class I	Class II	Others	population (in lakhs)
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 Islands	-	100.0	-	0.349
27	Chandigarh	100.0	-	-	1.612
28	Dadra & Nagar Haveli	-	-	100.0	0.023
29	Daman and Diu	-	-	100.0	0.095
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

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TABLE 7.2.11 : 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 : T.C.P.O., Ministry of Urban Affairs & Employment.

@ : Based on the percentage identified slum population of 1981.

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

* : Estimated

** : Based on the no. of identified Jhuggi collected by the State Govt. in 1991-92

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

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TABLE 7.2.12 : 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, India

* : Excluding Assam, and also 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 contaminated water are diarrhea, trachoma, intestine worms, hepatitis. Inadequate access to safe drinking water and sanitation facilities, leads to infant mortality and intestinal diseases.

TABLE 7.2.13 : STATEWISE PERCENTAGE DISTRIBUTION OF URBAN SLUM BY BASIC AMENITIES

S.No.	State	Basic Amenities		
		Safe Drinking Water	Electricity	Toilet Facility
1	Andhra Pradesh	86.8	6.3	33.7
2	Assam	—	34.8	92.2
3	Bihar	88.5	54.2	—
4	Gujarat	64.2	48.1	53.1
5	Haryana	100	14.4	42.6
6	Himachal Pradesh	—	—	—
7	Karnataka	95.2	72.5	17.6
8	Kerala	—	—	—
9	Madhya Pradesh	79.5	26.9	11.8
10	Maharashtra	98.3	21.0	76.6
11	Meghalaya	—	—	100.00
12	Orissa	89.7	13.1	—
13	Punjab -	100.00	56.4	—
14	Rajasthan	100.00	21.5	38
15	Sikkim	—	—	100
16	Tamilnadu	73.0	31.9	16.9
17	Uttar Pradesh	93.5	5.4	27.7
18	West Bengal	100.00	20.8	82.8
19	Chandigarh	—	—	100
20	Delhi	100.00	4.6	57.5
	All India	91.5	26.1	45.2

Source : Report No. 417, NSS 49th Round (Jan.-Jun 1993)

TABLE 7.2.14 : POPULATION COVERED WITH DRINKING WATER AND SANITATION FACILITIES (JAN.—JUNE 1998)

State	Sanitation Facility (% of population using latrine)		Drinking Water (% of population having drinking water within the premises)	
	Rural	Urban	Rural	Urban
Andhra Pradesh	11.5	69.2	18.2	42.7
Assam	75.3	98.0	52.8	80.9
Bihar	10.6	54.7	43.1	58.4
Gujarat	20.1	78.9	41.1	79.9
Haryana	15.5	67.1	30.0	83.2
Karnataka	11.1	70.0	18.9	59.0
Kerala	76.9	94.9	56.7	68.9
Madhya Pradesh	5.4	54.8	14.5	59.5
Maharashtra	14.2	84.2	30.3	77.5
Orissa	3.9	64.2	12.9	42.7
Punjab	32.1	85.2	83.4	93.8
Rajasthan	13.0	74.5	17.0	80.7
Tamil Nadu	11.5	67.5	17.5	49.7
Uttar Pradesh	9.4	71.8	51.1	76.5
West Bengal	23.9	84.8	26.3	48.9
North-East *	81.9	97.6	29.9	51.2
North-Western #	38.3	88.1	39.6	83.2
Southern @	32.7	72.1	43.7	72.7
All-India	**17.5**	**74.5**	**33.7**	**65.9**

Source: NSS 54th Round, January—June 1998

* : North-Eastern Group : Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim & Tripura

\# : North-Western Group : J&K, H.P., Chandigarh and Delhi

@ : Southern Group : A&N Island, Dadra & Nagar Haveli, Goa, Daman & Diu, Lakshadweep and Pondicherry

TABLE 7.2.15 : STATE-WISE ANNUAL REQUIREMENT OF WATER FOR DOMESTIC PURPOSES IN DIFFERENT STATES

(Cubic Km.)

S. No.	State/UT	Water Requirement	
		During 1991	Estimated for 2001
1.	Andhra Pradesh	2.548	2.927
2.	Arunachal Pradesh	0.027	0.038
3.	Assam	0.691	0.817
4.	Bihar	2.746	3.237
5.	Goa	0.053	0.074
6.	Gujarat	1.731	2.052
7.	Haryana	0.613	0.749
8.	Himachal Pradesh	0.153	0.201
9.	Jammu & Kashmir	0.284	0.371
10.	Karnataka	1.809	2.12
11.	Kerala	1.108	1.239
12.	Madhya Pradesh	2.419	2.968
13.	Maharashtra	3.466	4.044
14.	Manipur	0.071	0.099
15.	Meghalaya	0.061	0.085
16.	Mizoram	0.033	0.046
17.	Nagaland	0.041	0.058
18.	Orissa	1.01	1.153
19.	Punjab	0.803	0.942
20.	Rajasthan	1.602	1.984
21.	Sikkim	0.012	0.017
22.	Tamil Nadu	2.332	2.599
23.	Tripura	0.09	0.126
24.	Uttar Pradesh	4.864	6.094
25.	West Bengal	2.627	3.087
26.	Andaman & Nicobar Islands	0.011	0.015
27.	Chandigarh	0.044	0.062
28.	Dadra & Nagar Haveli	0.004	0.006
29.	Lakshadweep	0.003	0.004
30.	Pondicherry	0.045	0.063
31.	Delhi	0.643	0.981
32.	Daman & Diu	0.005	0.007
	All India	31.949	38.265

Source : Central Water Commission (Information System Directorate)

Norms : Rural Water Requirement = 70 Litres per capita per day
Urban Water Requirement = 200 Litres per capita per day

TABLE 7.2.16 : 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*	—	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	856	2893	2763	130	120	0	7	0	3	0
24	Uttar Pradesh	112566	43906	42894	1012	563	187	154	108	—	0

TABLE 7.2.16 : PROGRESS OF COVERAGE OF PROBLEM VILLAGES WITH SUPPLY OF DRINKING WATER—Concld.

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
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	557137	161722	153357	8365	3032	2365	2218	472	132	146

Source : Ministry of Rural Areas and Employment

Problem Villages : 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

* : Census could not be held in 1981 due to disturbed conditions.

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	3.64
1981+	159.46	23.34	46.14	3.83
1991*	217.61	25.71	36.47	3.59

Source :Census of India 1991, Final Population Tables, Paper 2 of 1992

\+ : Includes Population (Projected) of J & K.

* : Includes Interpolated Population of Assam where census could not be held in 1981 disturbed conditions

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

S. No.	Size Class	Growth %	
		1971–81	1981–91
1	100,000 & above	56.14	47.60
2	50,000-99,999	53.06	29.22
3	20,000-49,999	36.5	29.84
4	10,000-19,999	29.46	17.01
5	5,000-9,999	14.63	6.69
6	Under 5,000	28.34	-12.60
	All Classes	46.23	36.35

Source: Office of the Registrar General, India Part II A(ii) A-Series - 1991 Census

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).

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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	11.29
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	27.48
1991+	23	71.00	8.39	32.63

Source : Office of the Registrar General, 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 : PERCENTAGE 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	7.75	9.29	11.37	14.01	16.53
Class II : 50000-99,999	1.71	1.97	2.20	2.66	2.79
Class III : 20000-49,999	2.69	2.99	3.13	3.15	3.39
Class IV : 10000-19,999	2.34	2.27	2.17	2.12	2.01
Class V : 5000- 9,999	2.21	1.24	0.90	0.79	0.67
Class VI : Less than 5000	0.54	0.16	0.10	0.11	0.08
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*

Source : Office of the Registrar General, India

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 in 1981 & 1991 census.

\+ Includes the interpolated population of Assam in 1981

* Includes the projected population of J&K in 1991

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TABLE 7.4.1 : HAZARDOUS WASTE REGULATORY QUANTITIES

Waste category	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 oil-emulsions	1000 kilograms per year calculated as oil and 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.	5 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 : Tata Energy Research Institute.

TABLE 7.4.4 (a) : INDIVIDUAL COMPONENTS OF MUNICIPAL SOLID WASTE IN DELHI.

S. No.	Components	Percentage (By Weight)	Weight (T/Month)
1	Food Waste	25.22	39966.03
2	Paper	3.62	5736.60
3	Card board	3.08	4880.86
4	Plastics	4.17	6608.18
5	Textiles	0.52	824.04
6	Rubber	1.83	2899.99
7	Leather	0.37	586.34
8	Yard Waste	21.85	34625.61
9	Wood	1.72	2725.68
10	Glass	0.49	776.50
11	Tin	0.20	316.94
12	Aluminium	0.00	0
13	Other metals	0.25	396.17
14	Dirt, Ash	36.56	57936.48
	Total	99.88	158279.42

Source : Report on the Development of Statistics in Environmental Sector: Solid wases by Indian Society of Environmental Management, New Delhi

TABLE 7.4.4 (b) : RECYCLABLE COMPONENTS OF MSW IN DELHI

S. No.	Components	Percentage (By Weight)	Weight (T/Month)
1	Paper	3.62	5736.60
2	Cardboard	3.08	4880.86
3	Plastics	4.17	6608.18
4	Glass	0.49	776.50
5	Tin	0.20	316.94
6	Aluminium	0.00	0.00
7	Other Metals	0.25	396.17
	Total	11.81	18715.25

Source : Report on the Development of Statistics in Environmental Sector: Solid wases by Indian Society of Environmental Management, New Delhi

TABLE 7.4.4 (c) : FILLING COMPONENTS OF MSW IN DELHI

S. No.	Components	Percentage (By Weight)	Weight (T/Month)
1	Dirt, Ash	36.56	57936.48

Source : Report on the Development of Statistics in Environmental Sector: Solid wases by Indian Society of Environmental Management, New Delhi

TABLE 7.4.4 (d) : BIODEGRADABLE COMPONENTS OF MSW IN DELHI

S. No.	Components	Percentage (By Weight)	Weight (T/Month)	Carbon (T/month)	Nitrogen (T/Month)	C/N Ratio
1	Food Waste	25.22	39966.03	19183.70	1039.12	18.46
2	Yard Waste	21.85	34625.61	16551.04	1177.27	14.06
	Total	47.07	74591.64	35734.74	2216.39	16.12

Source : Report on the Development of Statistics in Environmental Sector: Solid wases by Indian Society of Environmental Management, New Delhi

TABLE 7.4.4 (e) : COMBUSTIBLE COMPONENTS OF MSW IN DELHI

S. No.	Components	Percentage (By Weight)	Weight (T/Month)
1	Paper	3.62	5736.6
2	Cardboard	3.08	4880.86
3	Plastics	4.17	6608.18
4	Textiles	0.52	824.04
5	Rubber	1.83	2899.99
6	Leather	0.37	586.34
7	Wood	1.72	2725.68
	Total	15.31	24261.69

Energy contents of Combustible Components (Dry) : 23583.62 KJ/T

Source : Report on the Development of Statistics in Environmental Sector: Solid wases by Indian Society of Environmental Management, New Delhi

TABLE 7.4.5 : PER CAPITA CONSUMPTION OF PLASTICS IN SOME SELECTED COUNTRIES OF WORLD

(in Kg.)

Country	Per Capita Consumption
India	1.6
India (2000)	4.0
Vietnam	1.5
China	6.0
Indonesia	8.0
Mexico	13.0
Thailand	18.0
Malaysia	22.0
Western Europe	60.0
Japan	70.0
North America	78.0

Source : Parivesh Newsletter, Sept.1998
Central Pollution Control Board.

CHART 17 : PER CAPITA CONSUMPTION OF PLASTIC (Kg)

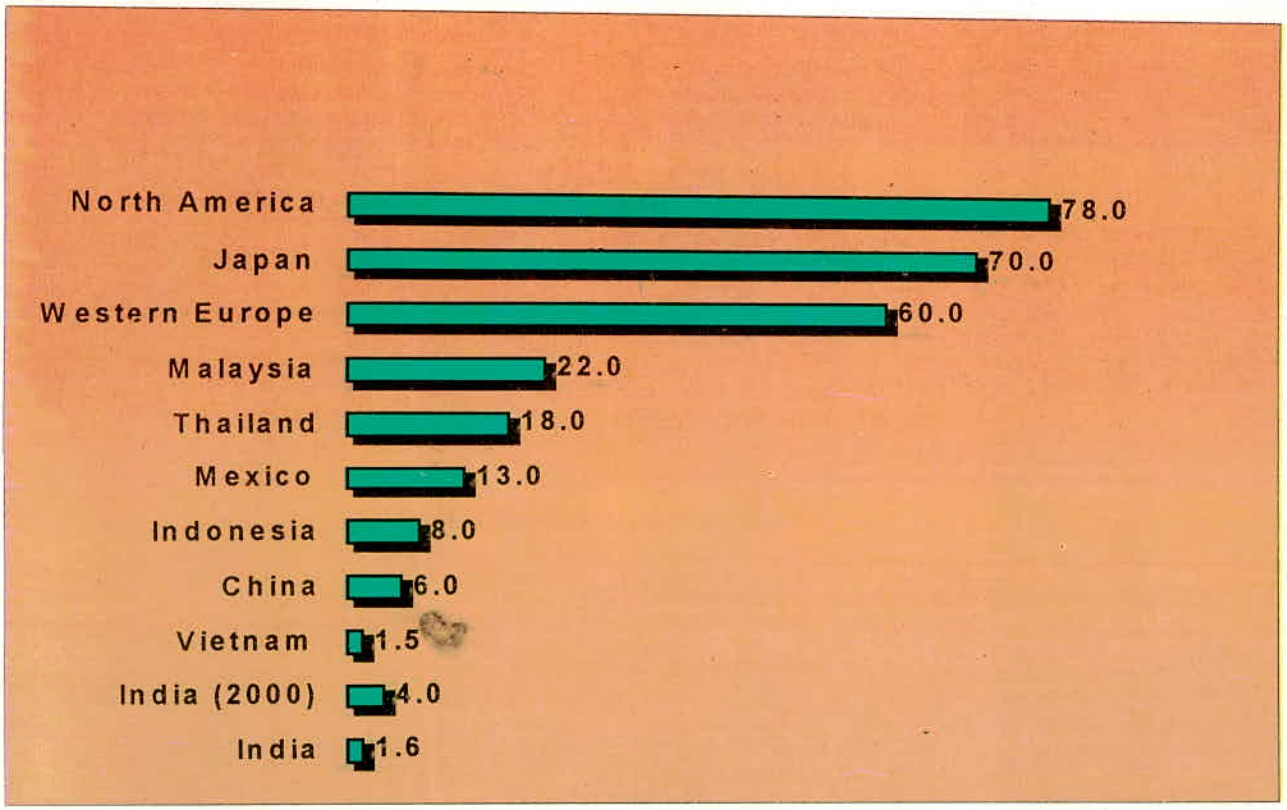

TABLE 7.4.6 : CONSUMPTION OF PLASTICS IN PACKAGING AND CONSUMER PRODUCTS

(in thousand tonne)

Item	1984	1990	1994	2000
Packaging	162	386	664	1518
Consumer Products	79	165	319	904
Building & Construction	73	159	228	490
Industrial Goods	80	137	222	478
Others	40	57	122	267

Source : Parivesh Newsletter, Sept.1998.
Central Pollution Control Board

Chart 18 : Consumption of Plastics (Thousand Tonnes)

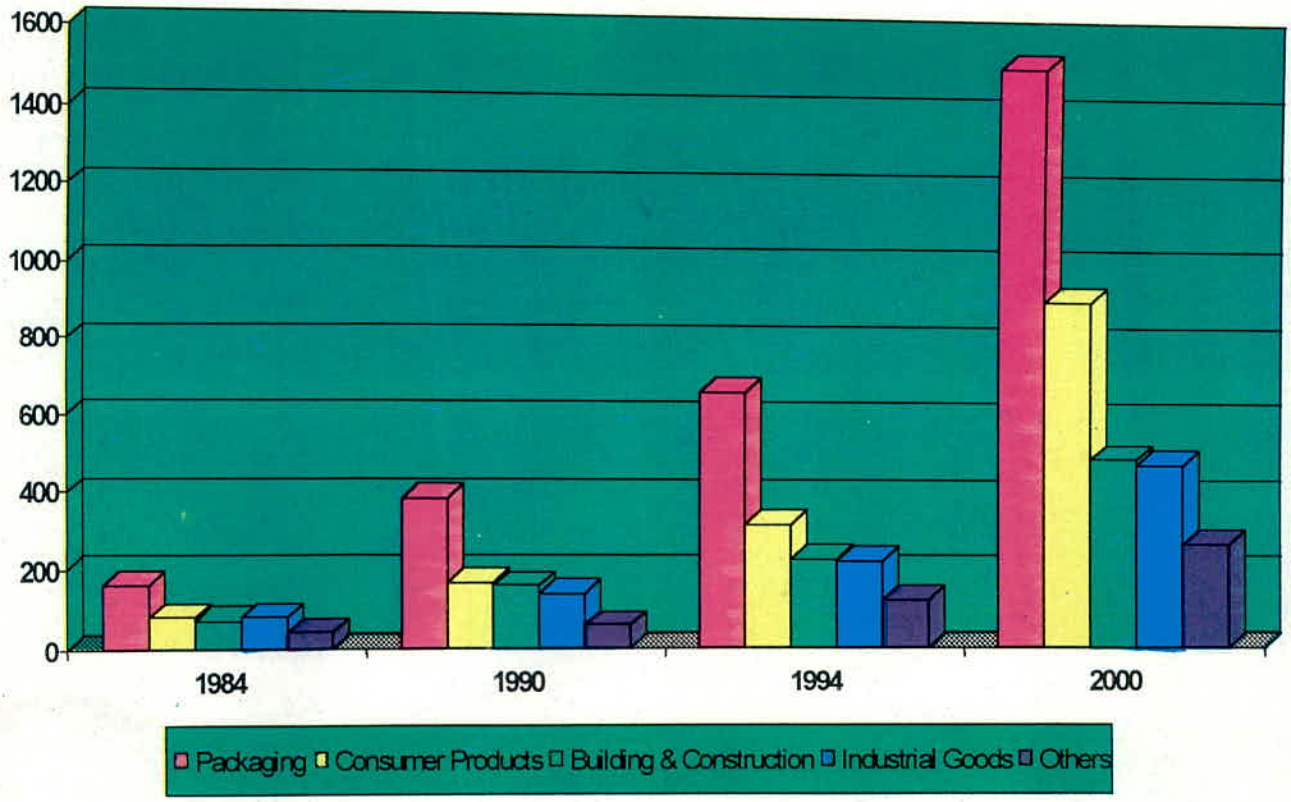

TABLE 7.4.7 : PLASTIC WASTE MANAGEMENT STATUS IN INDIA

(In thousand tonne)

	1995-96	Estimates by 2001
Consumption of Plastics	1889	4374
Waste available for Recycling	800	2000
Total	2689	6374

Source: Parivesh Newsletter, Sept.1998.
Central Pollution Control Board

TABLE 7.4.8 : 50 YEARS OF WASTE GENERATION

	1947	1997
Urban Population (million)	56.9	247
Daily per capita waste generation (grams)	295	490
Total Waste Generated (million tonnes)	6	48
Area Under land fills (Thousands of ha)	0.12	20.2
Annual methane emmission (tonnes) from landfill sites	0.87	7.1

Source : Central Pollution Control Board.

TABLE 7.4.9 : CHARACTERISTIC LAND - FILL LEACHATES

Parameters	Concentration (mg/l)
pH	3.7 - 8.3
Tot. Dis. Solid	725 - 55,000
Chlorides	2 - 11,373
Tot. Kj. Nitrogen	2 - 3,320
Lead	0 - 14.2
COD	50 - 99,000
BODS	0 - 19,500

Source : Central Pollution Control Board.

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TABLE 7.4.10 : STATUS OF MUNICIPAL SOLID WASTE MANAGEMENT IN SELECTED METROCITIES

City	Bangalore	Calcutta	Chennai	Delhi	Mumbai
Area (Sq. Km)	226.16	187.33	174.00	1484.46	437.71
Population (Projected for 1999, in millions)	5.31	6.00	5.00	12.20	12.50
MSW Generation (Tonnes/ day)	2200	3100	3050	6000	6000
MSW per capita (Kg/day)	0.414	0.517	0.610	0.492	0.480
Garbage pressure (tonnes/ sq. km)	9.728	16.548	17.529	4.042	13.708
Pressure on landfill	1400	2500	3050	5000	6000
Safai Karamchari	12600	12030	10130	40483	22128

Source : Central Pollution Control Board.

TABLE 7.4.11 : CURRENT STATUS OF MANAGEMENT OF MUNICIPAL SOLID WASTE

Cities	Class I	Class II
No. of Cities	299	345
Total Population	1281138655	22375588
Waste Generation (MT/d)	48134	1454
Mode of Collection		
Manually	50%	78%
Trucks	49%	21%
Others	1%	1%
Disposal		
Dumping	94%	93%
Composting	5%	6%
Others	1%	1%

Source : Central Pollution Control Board.

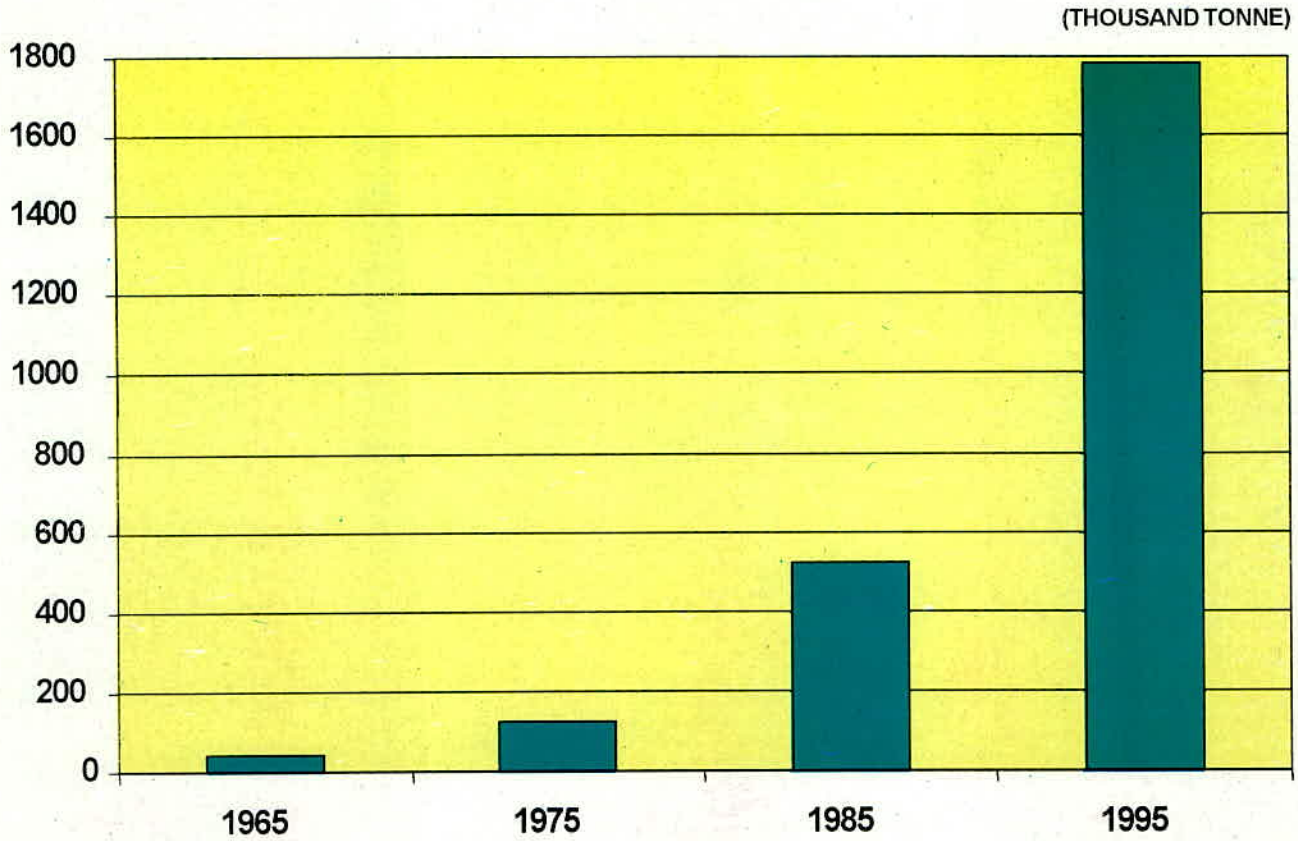
TABLE 7.4.12 : POLYMER DEMAND IN INDIA

(in thousand tonne)

Year	Demand
1965	44
1975	125
1985	523
1995	1780

Source: Parivesh Newsletter, Sept.1998
Central Pollution Control Board.

CHART 19 : POLYMER DEMAND IN INDIA



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
Cl	Chlorine
CPCB	Central Pollution Control Board
Cu.m	Cubic Metres
Fe	Iron
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
Mg	Magnesium
Mha	Million hectares
MOEF	Ministry of Environment and Forests
MW	Megawatts
NA	Not Available
Neg.	Negligible
NH_3	Ammonia
NIQ	Non-Institutional Qualified
NO_x	Oxides of Nitrogen
NO_2	Nitrogen dioxide
NO_3	Nitrate
NSFP	National Social Forestry Project
ODP	Ozone Depletion Potential
PM	Particulate matter
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
RSC	Residual Sodium Carbonate
SAR	Sodium absorption ratio
SFP	Social Forestry Project
SO_2	Sulphur dioxide
SO_4	Sulphate
SP	Sodium Percentage
SPM	Solid Particulate Matter
SWS	Sub-Water Shed
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.

Critical :

A taxon is critical when it is facing an extremely high probability of extinction in the wild in immediate future.

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 underground 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.

Insufficiently Known :

A taxon is Insufficiently Known when an evaluation has been made but the available data are inadequate to assign a category.

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.

pH :

The logarithm to the base 10 of the reciprocal of Hydrogen ion concentration.

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 auhorities 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 over exploitation, 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.

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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 this 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-napthyl)- 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 being not less than 1.1 cubic meter per minute.

Source : Ambient Air Quality – Status and Statistics, 1997, 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 (1996 & 1997)
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.

APPENDIX 7

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 :

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