Government of Kerala

COMPENDIUM OF ENVIRONMENT STATISTICS KERALA - 2004

DEPARTMENT OF ECONOMICS & STATISTICS

THIRUVANANTHAPURAM-695033

JUNE, 2004

Compendium of Environment Statistics Kerala -2004

NATURE NURTURES MAN.
CONSERVE, PRESERVE & PROTECT IT.

Directorate of Economics and Statistics,
THRIUVANANTHAPURAM –695033
June, 2004

PREFACE

The gift of nature could be effected the multifold human activities. The assets of natural environment are directly or indirectly, actually or potentially affected by human activities are called natural assets. Natural assets consists of biological assets, land and water areas, sub soil assets, air etc. It is necessay to maintain and preserve natural resource and made accountable

The Western Ghats Region of Kerala comprises of 31 Taluks covering around 72% of the geographical area and around 50% of the population in the State. Out of the total length of 1600 Kms. of hill ranges under Western Ghats, about 450 Kms is in Kerala covering 28% of the geographical area of the region. This gift of nature protected the state of Kerala having a good eco-system. Degradation of this eco-system at any way will have adverse effect on human life.

Realising the importance of the need for preserving the Environment and Ecological balances, serious efforts are being taken by the Central and State Governments.

Environment Statistics is very much needed by the policy makers, planners and Administrators and Activists who are concerned with environment. This publication will serve the above to a greater extent.

Central Statistical Organisation, Government of India have published regularly " The Compendium of Environment Statitics in India". On the same lines Directorate of Economics and Statistics, Government of Kerala has made an earnest effort to collect, compile and publish data on various aspects of environment relating to Kerala.

This publication has been categorised into different chapters so as to make it easy for reference.

In this context we acknowledge our thanks to various departments such as Kerala State Pollution Control Board, Department of Forests etc.

This publication is an outcome of the earnest effort of Dr. T. Bhavana. Deputy Director under able guidence of Sri. P.Kuchunarayanapillai, Additional Director. The assistance and co-operation rendered by Sri.M.Girish Babu, Research Officer, Sri. K.Radhakrishnan U.D. Compiler, Sri R. Anilkumar L.D.Compiler of Evaluation unit, and Sri. K.K.Basand Kumar, Scrutiny Officer and Sri. S.'Saseendran U.D Typist of Computer Division is also acknowledged..

Thiruvananthapuram

30-6-2004

M.R. BALAKRISHNAN
DIRECTOR

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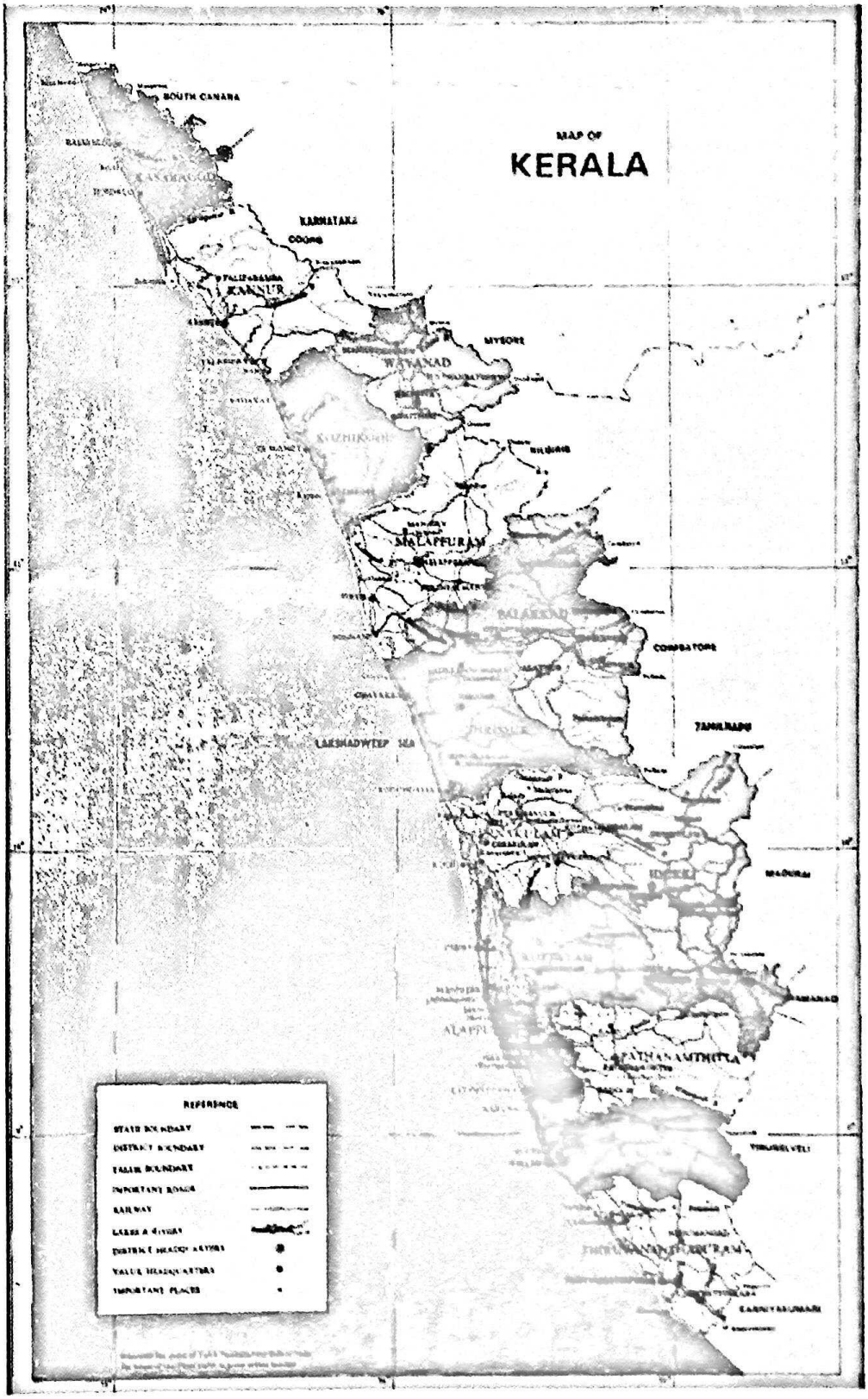

MAP OF
KERALA
SOUTH CANARA
KARNATAKA
COORG
KANNUR
WAYANAD
MYSORE
NILGIRIS
MALAPPURAM
COIMBATORE
TAMILNADU
LAKSHADWEEP SEA
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
TALUK BOUNDARY
IMPORTANT ROADS
RAILWAY
DISTRICT HEADQUARTERS
TALUK HEADQUARTERS
IMPORTANT PLACES

CHAPTER – I

ENVIRONMENT AND ENVIRONMENT DEGRADATION

The UN Conference of Environment Development (UNCED) held in Rio-de Janeiro in 1992, followed by the Johannesburg Conference on Sustainable Development 2002 have proclaimed to conserve, preserve and protect our natural resources on a sustainable basis in the best interest of the people. Man is a part of nature. His activities are interlinked with environment. In that sense, Environment can be defined as the physical surrounding of man for his existance on this earth. It includes all the gifts of nature (natural resources) and the surroundings which are made by man (man made – artificial buildings roads, etc.) for his physiological functioning.

Human development on this earth transforms indoor and out door environmental changes. Indoor environment is mainly related to the health risks due to the man made surroundings. Outdoor environment is due to the economic development process. The cost of development activities can be measured in terms of environmental degradation. Its incidence would be very high in future. The state of Kerala is considered as God's Own Country. But the present environment situation of the state has not yet been properly assessed. Assessments are required regularly to guide, rational and effective decision making for environment policy formulation. The sand mining, destruction of forests, over consumption of manufatured goods etc., adversely affects our environment.

TABLE – 1.1.1

SOME IMPACTS OF DEVELOPMENT ACTIVITIES ON ENVIRONMENT

Sl. No.	Development activities	Major impacts on Environment
1.	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.
2.	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.
3.	Agro Industries	Air pollution due to burning of bagasse as fuel in sugar mills, Large amount of highly polluting organic wastes, surface water pollution.
4.	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.
5.	Use of pesticides	Organism develop resistance and new control methods are needed (e.g. in malaria, wide spread use of dieldrin as a prophylactic agent against pests of oil palms made the problem worse), Creation of complex and wide spread environment problems. The pesticides used in agriculture sometimes go into food Chain or in water bodies and as such results in harmful health hazards.
6.	Timber extraction	Degrades land destroys surface soil, reduces production potential of future forests.
7.	Urbanisation and industrialization	Concentration of Population in urban centers make huge demands on production in rural areas and put pressure on land, air and water pollution.
8.	Water resource projects e.g. Dam, extensive irrigation	Human settlement and resettlement, spread of water born diseases, reduction of fisheries, siltation, physical changes. e.g. temperature, humidity

Source: Compendium of Environment Statistics, 2001.

1.2 Emissions, Discharges and Their Sources.

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

TABLE – 1.2.1
LOCAL REGIONAL AND GLOBAL EFFECTS OF POLLUTION

Local Effects	Regional	Over Marine water and continents	Global
▪ Heavy metals in air, soil and plants, e.g. From Industrial emissions and discharges ▪ Noise ▪ Smell ▪ Air Pollution	▪ Eutrophication ▪ Contaminants in the soil ▪ Landscape changes due to mining on agriculture	▪ Eutrophication ▪ Acidification ▪ Environment ▪ Contaminants ▪ Radioactivity	▪ Change of the climate due to ozone depletion and the greenhouse effect

Source: Compendium of Environment Statistics, 2001.

TABLE – 1.2.2

SOME MAJOR POLLUTANTS AND THEIR SOURCES

Pollutant	Source
Carbon Monoxide	Incomplete fuel combustion (e.g. two stroke Engine)
Sulplur dioxide	Burning or 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 Engine, industrial processes, disposal of solid wastes)
Oxidonts and ozone	Emissions from motor vehicles, photo chemical reactions of nitrogen oxides and reactive by hydrocarbons.
Lead	Emissions from motor vehicles.

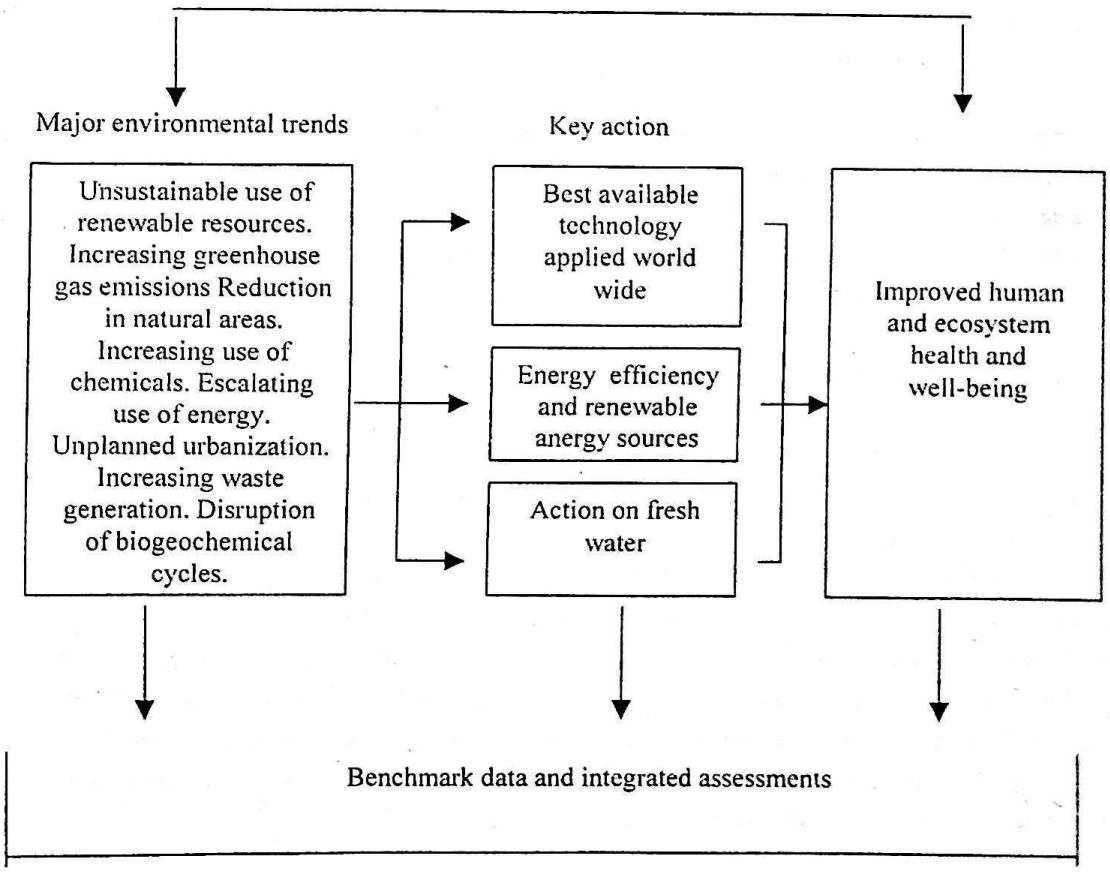
Source: Compendium of Environment Statistics, 2001.

TABLE – 1.2.3
POLLUTANTS AND THEIR RELATED HEALTH HAZARDS

Pollutant	Health Effects
Carbon Monoxide (from gasoline cars, 2-wheelers, 3-wheelers)	Fatal in large doses: aggravates heart disorders: affects central nervous systems: impairs oxygen carrying capacity of blood
Nitrogen Oxides (No)(from diesel vehicles)	Irritation of respiratory tract
Ozone	Eye, nose and throat irritation: risk asthmatics, children and those involved heavy exercise.
Lead (From petrol vehicles)	Extremely toxic: affects nervous system and blood : can impair 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.
Policyclic Aromatic Hydro carbons PAH (From Diesel Vehicles)	Carcinogenic

Source: Compendium of Environment Statistics, 2001.

Figure – 1.1



Source: Compendium of Environment Statistics, 2001, Economics and Statistics.

TABLE – 3.1.2
RARE AND THREATENED SPECIES (VASCULAR PLANTS) IN KERALA

Year:2003

Category	Region	Area
Rare and Endangered	Western Ghats	28007.28 Sq. km.

TABLE – 3.1.3
REFERENCE COLLECTION OF FLORA

Year: 2003

Sl. No	Category	Total Number
1.	Fungi	1044
2.	Algae	231
3.	Bryophytes	350
4.	Lichens	800
5.	Pteridophytes	236
6.	Gymnosperms	4
7.	Angiosperms	3800
8.	Grass species	350
9.	Bamboo species	15
10.	Reeds species	9
11.	Orchid species	214
12.	Ferns and Fernallies	200
13.	Live worts	200

Source : Botanical Survey of India- Department of Horticulture & Plantation Crops.

'Sarpagandhi' - Rabolfia Serpentena

CHART 3.1.2

CHART : REFERENCE COLLECTION OF FLORA

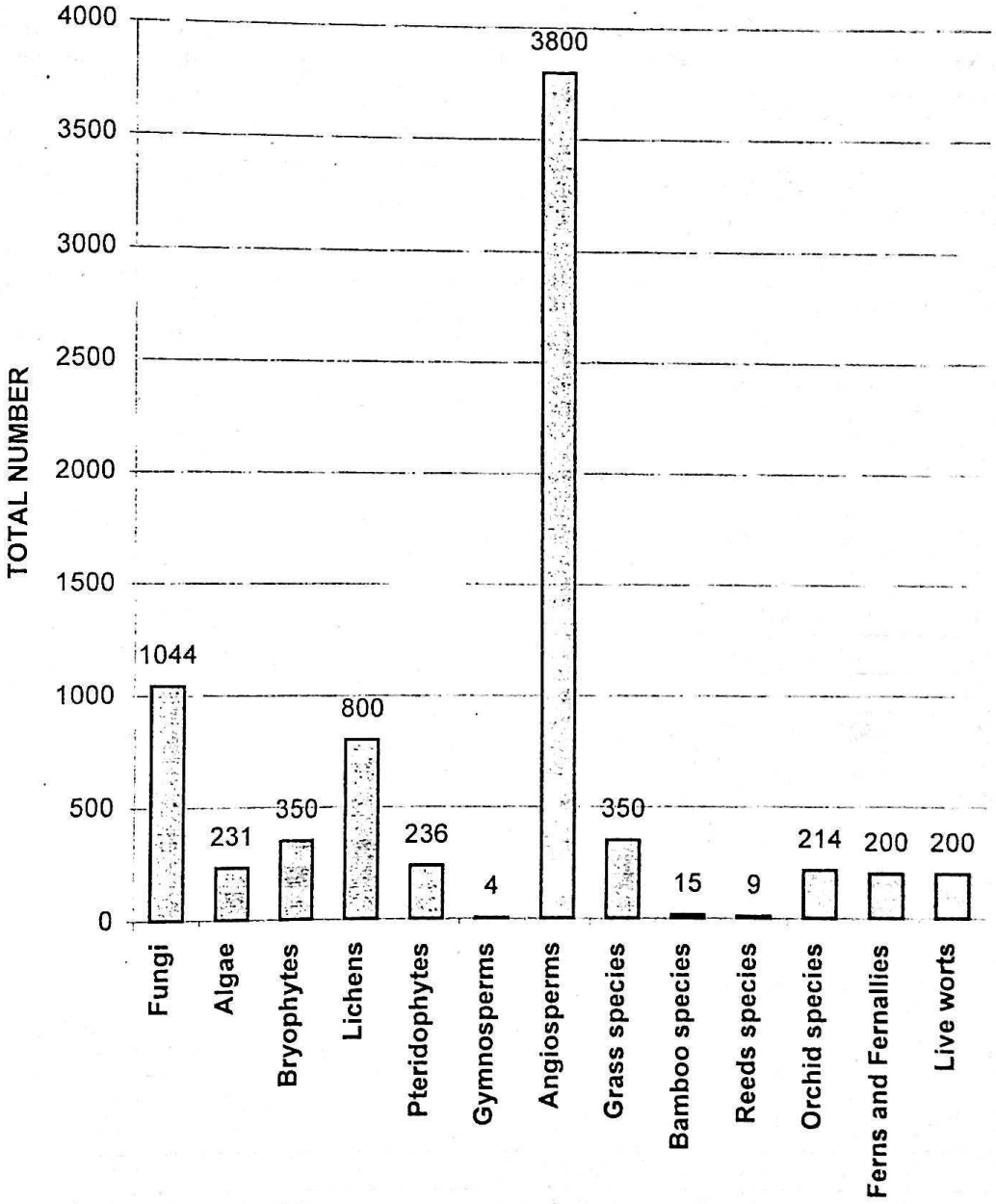


TABLE – 3.1.4

SANCTUARIES, NATIONAL PARKS, BIOSPHERE RESERVES AND OTHER PROTECTED AREAS IN KERALA

Sl No	Name of NP/WLS/BR	Area in Sq.KM.	Year of formation
1.	Periyar WLS	777.00	1950
2.	Neyyar WLS	128.00	1958
3.	Peechi – Vazhani WLS	125.00	1958
4.	Parambikulam WLS	285.00	1973
5.	Wayanad WLS	344.44	1973
6.	Eravikulam WLS	97.00	1978
7.	Idukki WLS	70.00	1976
8.	Thattekkad BS	25.00	1983
9.	Peppara WLS	53.00	1983
10.	Cimmony WLS	85.00	1984
11.	Chinnar WLS	90.44	1984
12.	Shendurney WLS	171.00	1984
13.	Aralam WLS	55.00	1984
14.	Silent Valley NP	89.52	1984
Total Protected Area		**2395.40**	
15.	Nilgiri Biosphere Reserve	1455.40	1986
16.	Agasthyavanam Biological Park	30.00	1992

Source : Principal Chief Conservator of Forests, Kerala.

FOREST :

TABLE – 3.2.1

DIVISION-WISE AREA OF FOREST IN KERALA(AS ON 31.3.2003)

Area in sq.kms.

Sl.No.	Division	Reserve forest	Proposed for reserve	Vested forest	Total
1	Thiruvanthapuram	359.124	5.825	3.651	368.600
2	Thenmala	204.323	-	6.895	211.218
3	Achenkovil	268.794	-	0.206	269.000
4	Ranni	1050.336	7.160	1.568	1059.064
5	Punalur	280.051	-	0.169	280.220
6	Konni	320.643	11.021	-	331.664
7	Kothamangalam	316.845	-	0.158	317.003
8	Munnar	662.750	60.073	7.367	730.190
9	Kottayam	655.486	5.257	31.409	692.152
10	Vazhachal	413.944	-	-	413.944

CHART : THE PLANT SPECIES DIVERSITY IN KERALA

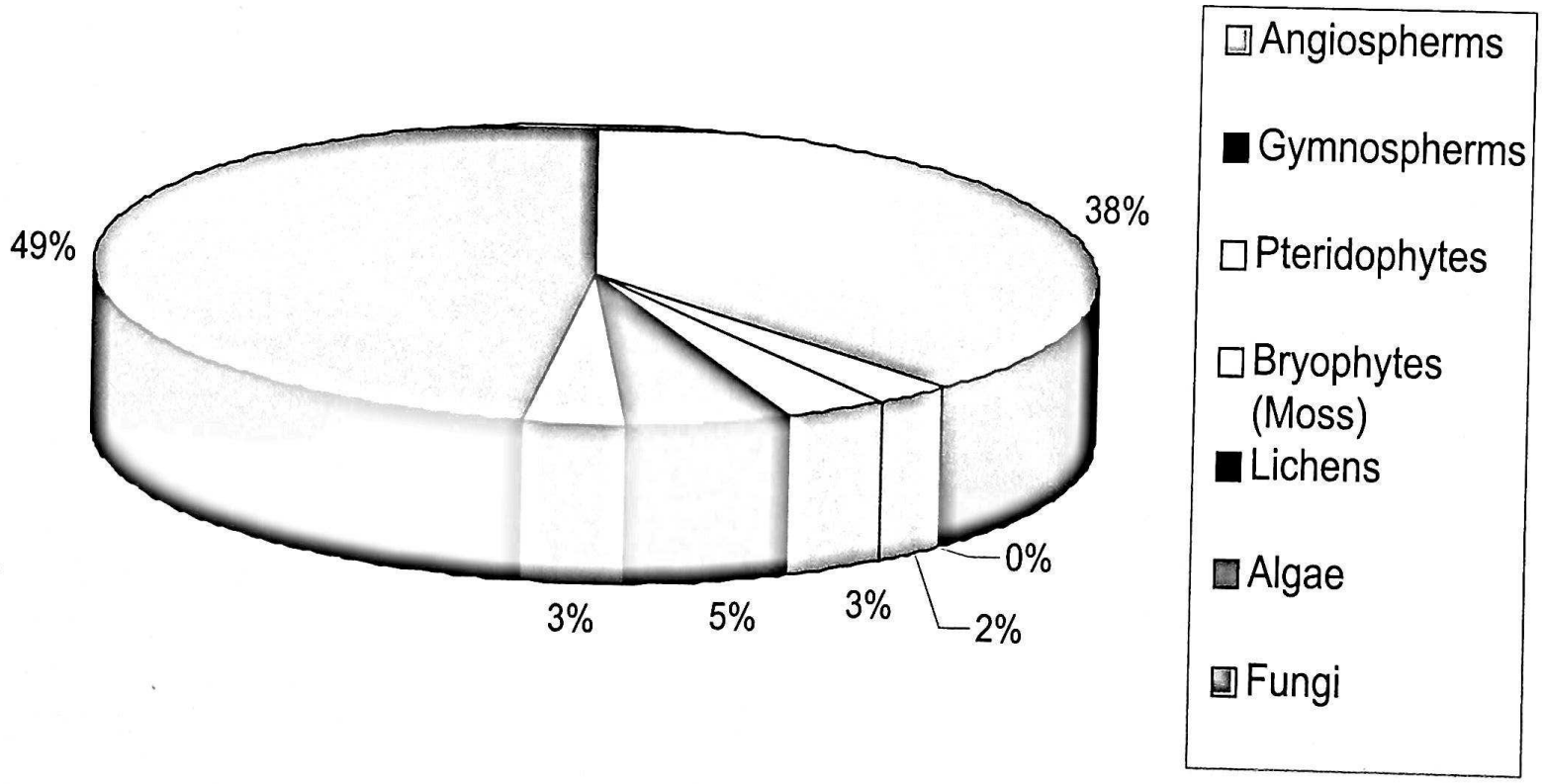


TABLE – 3.2.1 Contd...

Sl.No.	Division	Reserve forest	Proposed for reserve	Vested forest	Total
11	Chalakudi	279.710	-	-	279.710
12	Malayattoor	617.241	0.525		617.766
13	Thrissur	204.293	-	5.715	210.008
14	Mannarkkad	209.982	-	319.586	529.568
15	Nilambur North	57.920	0.017	340.703	398.640
16	Nilambur south	267.389	-	97.763	365.152
17	Palakkad	73.410	-	162.669	236.079
18	Nenmara	205.517	-	150.314	355.831
19	Kozhikode	24.164	22.730	243.088	289.982
20	Wayanad North	134.024	15.064	66.062	215.150
21	Wayanad South	67.518	6.845	272.706	347.069
22	Kannur	206.388	5.497	90.196	302.081
23	Thiruvanathapuram WL	181.000	-	-	181.000
24	Idukki	130.524	-	-	130.524
25	Perriyar East	620.000	-	-	620.000
26	Periyar West	157.000	-	-	157.000
27	Agathyavanam	30.447	1.553	-	32.000
28	Parambikulam	274.141	-	-	274.141
29	Wayanad	344.440			344.440
30	Silent Valley	89.516	-	-	89.516
31	Senthuruni	166.420	-	4.580	171.000
32	Eravikulam	187.442	-	-	187.442
33	Peechi	201.725	-	-	201.725
34	Aralam	22.357	-	32.643	55.000
Total :		**9284.864**	**141.567**	**1837.448**	**11263.879**

TABLE – 3.2.2

FOREST COVER AS PER LATEST ASSESSMENT

(Area in Sq.Kms)

State	Recorded forest area		Forest cover 1999		Forest cover 2001		
	Dense	Open	Open	Total	Dense	Other	Total
Kerala	11221 (28.87)*	8429	1894	10323	11772	3788	15560

* Percentage to geographical area

TABLE – 3.2.3

FOREST AREA BY OWNERSHIP

(Area in Sq. Kms)

Year	Forest Department					Others		
	Reserved	Protected	Unclassed (Mangroves)	Total	Area under Sanctioned working plans	Revenue depots forest	Corporate bodies/ Forest/ Community	Private forest
2000-2001	10971.1344	180.9469	15.5	11167.581	11152.0815	NIL	NIL	NIL
2001-2002	11119.6344	128.6574	15.5	11263.792	11248.2918	NIL	NIL	NIL

TABLE – 3.2.4

FOREST AREA BY COMPOSITION

Area in sq.kms

Year	Coniferous Forest			Non-coniferous Forest				Coniferous & Non-coniferous Mixed	Total
	Chir	Deodar	Other Conifers	Sal	Teak	Mangrove	Others		
2000-2001	NIL	NIL	NIL	NIL	754.4314	15.5	10397.65	NIL	11167.5813
2001-2002	NIL	NIL	NIL	NIL	748.718	15.5	10499.574	NIL	11263.7918

TABLE – 3.2.5

PRODUCTION OF MAJOR FOREST PRODUCE

SL No	ITEM	Unit	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02
1.	Timber (Round Logs)	cum	78691	123501	61430	51972	19246	26664	44519	31299	38915
2.	Timber (Round Poles)	Nos	725231	779507	361179	683391	287243	275050	455389	129349	245254
3.	Timber (Swan & Squard)	cum	226	10	30	4	2	10	7	3	8.668
4.	Fire Wood	MT	33409	82888	45336	29877	11291	18424	14191	8105	11182
5.	Cardomom	Kg	1459	4379	3155	1233	1717	2758	4249	4687	2911.5
6.	Honey	Kg	65655	37512	74787	72161	71214	21376	41734	47976	57069
7.	Reeds	Nos	64783879	57647490	49615070	56840410	63239268	62708610	39576143	49047940	32610487
8.	Bamboo	Nos	1810194	1596297	1339741	4829421	2338472	2088407	627805	1390456	1305620
9.	Jungle Wood Poles	Nos	174	5282	64	289	7054	670	---	212	2397
10	Sandal Wood	Kg.	218424	112726	133847	103523	171252	17762	97028	405	23968

Source: Forest Department

Table : 3.2.6

Salient features of the floristic 'Hot Spots' of Kerala.

Sl. No.	Agasthyamala	Anamali- high ranges	Silent valley – Wayanad
1	Highest peak – Agastyakundam (1868 m)	Highest peak –Anamudi (2694 m)	Wet evergreen, moist deciduous, shola and Grasslands, forests, the main types of vegetation.
2.	Rainfall on the wind ward side- 3000 to 5000 mm/annum.	Rainfall on the windward side –3000 to 7000 mm/annum	Five endemic genera-Chandra sekhararica,Bacolepi's, Kanjarum, Meternmyrtus, and Silent valleya.
3.	Acnhenrya, an endemic orchid genus – exclusively occurring in the region	Endemic genera- Haplothisma, Pseudogloctridon and Utleria.	Major centers of genetic resources of Turmeric,Pepper, Canes and Aroids
4.	About 189 endemic species, occur in Small population over narrow ranges.	Mountain folds form a mosaic ofmicroclimatic islands due to uniquephysiography, high altitude, heavy rainfall and diurnal temperature.	Area comprises of Palakkad gap, Silent valley, Wayanadu and adjacent forests of Kannore district
5.	Recent surveys have discovered 35New species.	Plantation of Tea, cardamom and rubberhave destroyed major components of wet evergreen and deciduous forests.	About 40000 hectares of contiguous forestsand one of the few area in India without human habitation and large-scale intervention.
6.	5 wild life sanctuaries in the region	Eravikulam National Park and 7 wild life sanctuaries in the region	Wild life which has almost eliminated from other parts of the country such as the Nilgiri Languor, giant squirrel and Lion tailed Macaque being survived here.
7.	Serious human interference due topoaching, smuggling and pilgrim influx.		

FAUNA :

TABLE – 3.3.1

MINIMUM NUMBER OF GENERA/SPECIES OF ANIMALS RECORDED FROM KERALA

Groups	No. of Genera	No. of Species	No. of Species World total
Vertebrates (Animals with backbone) Pisces(Fishes)		196	19056
Amphibia(amphibians)		86	4184
Reptilia(Reptiles)		142	6300
Aves (birds)		475	9040
Mammalia (mammals)		75	4000
Invertebrates (Animals without backbone) Protozoa	63	--	30800
Porifera (sponges)	22	--	5000
Coelenterata (jelly fish, corals)	90	--	9000
Platyhelminthes (Flatworms)	117	--	12200
Acanthocephala	16	27	--
Aschelminthes	265	121	--
Annelida (earth worms, leaches)	46	91	12000
Chaetognatha	4	18	--
Mollusca (snails, oysters, etc)	19	26	50000
Echinodermata (starfish, sea cucumbers)	7	8	6100
Insecta (insects)	193	6000	751000
Non-insect Anthropoda (crustaceans, mites, spiders)	242	--	123161

TABLE – 3.3.2

NUMBER OF SPECIES OF MAMMALS RECORDED FROM KERALA

Order	Family	No. of Species
Primates	Cercopithecidae	4
	Lorisidae	1
Carnivora	Felidae	6
	Mustelidae	3
	Viverridae	4
	Herpestidae	4
	Hyaenidae	1
	Canidae	2
	Ursidae	1
	Erinaceidae	1
Insectivora	Soricidae	1
Chiroptera	Pteropodidae	4
	Vampyridae	7
	Noctilionidae	3
	Vesperilionidae	8
Reodentia	Muridae	8
	Sciuridae	6
	Hystricidae	1
	Leporidae	1
Proboscidea	Proboscidae	1
Artiodactyla	Bovidae	1
	Caprinae	1
	Cervidae	3
	Tragulidae	1
	Suidae	1
Pholidota	Manidae	1
Total		**75**

TABLE – 3.3.3

LIVE STOCK POPULATION (IN NUMBERS) AS PER 1996 CENSUS

SL NO	DISTRICT	Cattle			Buffaloes	Sheep			Total Goats	Pig		
		Cross Breed	Indigenous	Total		Cross Breed	Indigenous	Total		Cross Breed	Indigenous	Total
1	Thiruvananthapuram	201600	53916	255516	15304	0	378	378	192017	871	3812	4683
2	Kollam	203245	72995	276240	8887	0	442	442	170476	470	878	1348
3	Pathanamthitta	147400	53685	201085	3269	0	55	55	84706	398	1277	1675
4	Alappuzha	138807	34569	173376	4237	0	74	74	89939	378	866	1244
5	Kottayam	191781	37804	229585	4358	32	85	117	148896	8638	24419	33057
6	Idukki	179642	70307	249949	14591	553	895	1448	139102	15796	33096	48892
7	Ernakulam	209198	74261	283459	10173	0	153	153	158399	3984	10847	14831
8	Thrissur	177328	75764	253092	19618	54	102	156	160927	3242	2816	6058
9	Palakkad	217616	145722	363338	35693	0	490	490	162488	826	1413	2239
10	Malappuram	151045	93180	244225	23271	66	564	630	209968	193	523	716
11	Kozhikode	125590	132374	257964	1910	0	190	190	113656	854	1017	1871
12	Wayanad	120606	42904	163510	10435	880	293	1173	72518	7211	4588	11799
13	Kannur	159829	92301	252130	3982	40	624	664	101807	2740	6897	9637
14	Kasaragod	63189	129677	192866	9397	0	88	88	55607	1204	3530	4734
	STATE TOTAL	**2286876**	**1109459**	**3396335**	**165125**	**1625**	**4433**	**6058**	**1860501**	**46805**	**95979**	**142784**

Source : Directorate of Animal Husbandry.

TABLE – 3.3.4
FISH PRODUCTION IN KERALA.

[in '000' Tones]

YEAR	MARINE	INLAND	TOTAL
1978 – 79	368	25	393
1979 – 80	329	25	354
1980 – 81	368	26	394
1981 – 82	305	26	331
1982 – 83	348	26	374
1983 – 84	418	27	445
1984 – 85	365	28	393
1985 – 86	351	29	380
1986 – 87	311	28	339
1987 – 88	286	27	313
1988 – 89	375	28	403
1989 – 90	536	33	569
1990 – 91	677	36	713
1991 – 92	541	40	581
1992 – 93	554	42	596
1993 – 94	559	45	604
1994 – 95	549	48	597
1995 – 96	541	50	591
1996 – 97	661	52	713
1997 – 98	511	58	569
1998 – 99	560	66	626
1999 – 00	594	73	667
2000 – 01	567	85	652
2001 – 02	594	78	672
2002 - 03	603	75	678

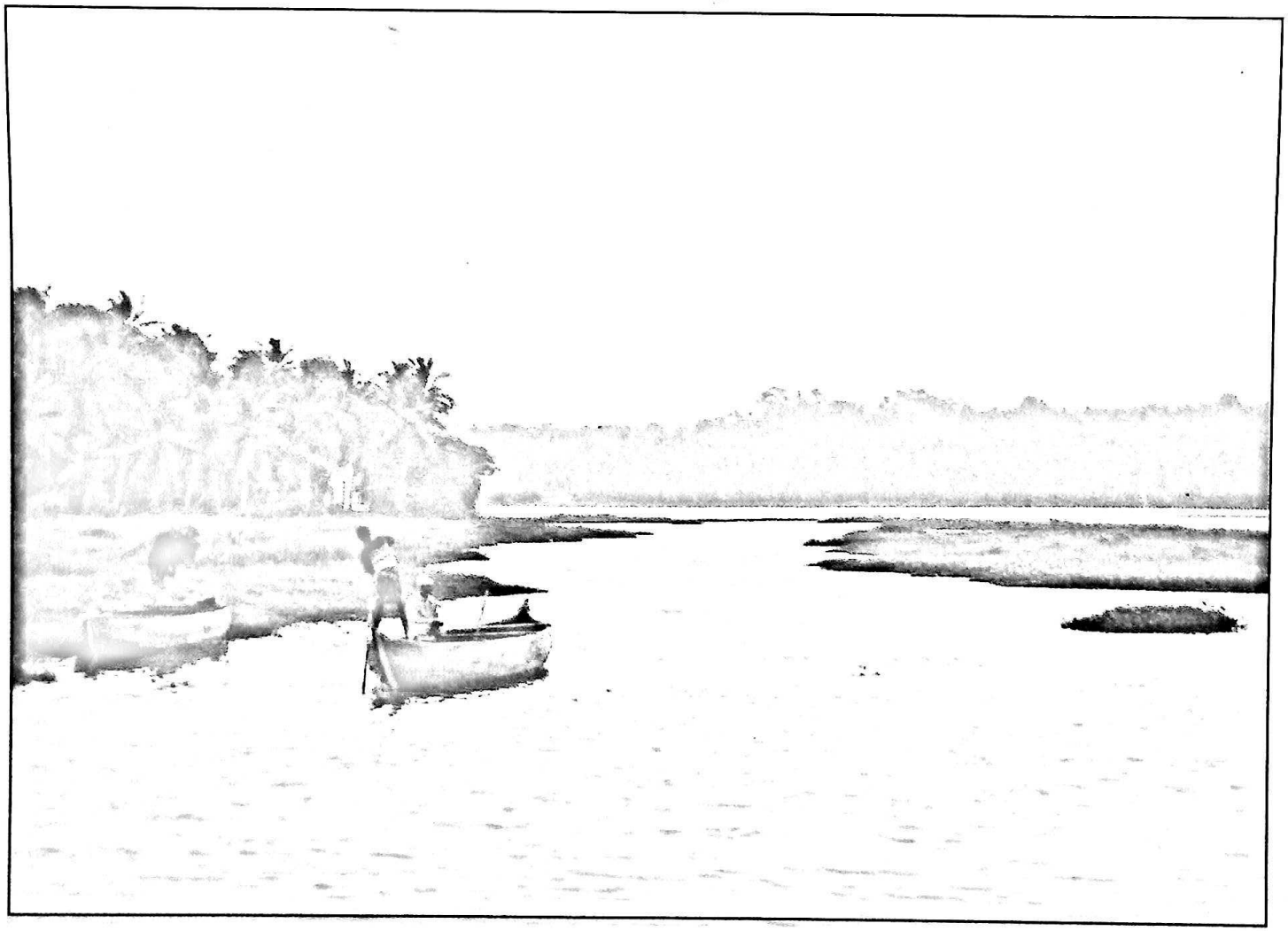
Source: Directorate of Fisheries, Kerala.

TABLE – 3.3.5
MARINE FISHERY RESOURCES OF KERALA (2002-03)

Sl No.	District	Coastal Length (Km)	No. of Fishing Villages – Marine	No. of Fish Landing Centers
1.	Thiruvananthapuram	78	42	5
2.	Kollam	37	27	7
3.	Alappuzha	82	30	5
4.	Ernakulam	46	21	5
5.	Trissur	54	18	7
6.	Malappuram	70	23	7
7.	Kozhikode	71	34	3
8.	Kannur	82	11	4
9.	Kasargode	70	16	6
TOTAL		**590**	**222**	**49**

Source:

1. *Marine fisheries of Kerala at a glance,2003*
2. *Facts and Figures –2000, Department of Fisheries.*



The Backwaters

TABLE – 3.3.6

MARINE FISH PRODUCTION FOR THE YEARS –DISTRICT WISE DETAILS

SL. NO	DISTRICT	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1.	Thiruvananthapuram	43995	37235	27554	36577	25101	36253	58742	39927	51094	49150	52087	49705	52092	42369
2.	Kollam	159634	123297	141932	157303	135915	103822	127200	99715	111038	138122	142358	135848	142373	123434
3.	Alappuzha	117358	93449	49639	44585	75768	56805	72340	107524	79459	114633	121887	116314	121900	115444
4.	Ernakulam	100334	86942	83341	103466	101592	68742	92024	62340	60028	53252	60230	57476	60237	60587
5.	Trissur	29458	33935	28226	31915	29896	74052	35564	44991	61551	44562	44267	42243	44272	72544
6.	Malappuram	94308	77823	66775	26297	60605	49841	25926	37394	40351	44800	36533	34862	36536	34121
7.	Kozhikode	80920	57270	116101	132139	87125	112475	124775	129545	81994	58990	95794	91413	95804	103900
8.	Kannur	13684	23658	21842	26943	36242	19877	21413	28806	31823	39263	31916	30457	31920	30888
9.	Kasaragod	23199	31976	25161	15518	15819	9779	14071	24532	25358	8001	8648	8253	8649	19999
TOTAL		**662890**	**565585**	**560571**	**574743**	**568063**	**531646**	**572055**	**574774**	**542696**	**580773**	**593720**	**566571**	**593783**	**603286**

Source : Marine fisheries of Kerala at a Glance – 2003
Kerala Fisheries at a Glance-2004

TABLE – 3.3.7

INLAND FISHERY RESOURCES OF KERALA

Sl No	District	Area of Reser-voir (in hec)	Area under Ponds & Tanks (in hec.)						
			Private ponds	Panch-ayath ponds	Quarry ponds	Holy ponds & Streams	Village ponds & water holds	Tanks	Brackishwater (in hec)
1	Thiruvananthapuram	2340	15.22	297.25	2.46	20.03	0	1.54	1424
2.	Kollam	2590	205.18	62.93	137.97	24.96	35.55	150.26	8604
3.	Pathanamthitta	2505	44.03	43.28	24.93	3.97	--	15.48	--
4.	Alappuzha	--	18680.39	322.56	1.65	44.24	--	16.18	15223
5.	Kottayam	--	385.16	19.05	13.44	25.53	0.4	19.07	4327
6.	Idukki	18651	36.25	2.81	1.94	0.71	--	4.03	--
7.	Ernakulam	608	747.14	233.17	37.14	26.94	245.94	13.98	16213
8.	Thrissur	3706	559.58	240.68	16.72	111.77	40.48	507.72	4272
9.	Palakkad	7132	948.27	176.84	55.16	145.59	35.25	759.18	--
10.	Malappuram	--	118.90	38.14	35.31	15.43	2.04	6.10	1796
11.	Kozhikode	3172	114.25	13.53	4.33	17.64	2.10	1.11	4162
12.	Wayanad	2937	47.64	5.16	3.3	2.08	10.66	5.44	--
13.	Kannur	648	56.65	19.86	6.26	35.77	97.13	90.01	5944
14.	Kasaragod	--	27.78	11.43	0.47	4.71	25.94	1244.28	3248
	TOTAL	44289	21986.44	1486.80	341.08	479.37	495.49	2834.38	65213

Source: Facts and Figures –2000, Dept. of Fisheries

TABLE – 3.3.8

DISTRICT-WISE DISTRIBUTION OF FISHERMEN POPULATION IN KERALA (2002-03)

SL NO	DISTRICT	MARINE				INLAND				MARINE & INLAND TOTAL
		Male	Female	Children	Total	Male	Female	Children	Total	
1.	Thiruvananthapuram	52601	50929	72324	175854	457	482	478	1417	177271
2.	Kollam	31826	29138	38007	98971	11511	10972	13519	36002	134973
3.	Pathanamthitta					610	743	1086	2439	2439
4.	Alappuzha	36576	35376	45514	117466	21585	20830	23025	65440	182906
5.	Kottayam					8644	8450	9112	26206	26206
6.	Idukki					331	252	236	819	819
7.	Ernakulam	24849	24054	27567	76468	23045	22411	22182	67638	144106
8.	Thrissur	22650	22929	27998	73577	6892	6760	7270	20922	94499
9.	Palakkad					761	859	1122	2742	2742
10.	Malappuram	24880	25452	34053	84385	1461	1453	1689	4603	88988
11.	Kozhikode	32717	31533	39890	104140	4024	3903	4790	12717	116857
12.	Wayanad					95	89	101	285	285
13.	Kannur	18139	17225	23458	58822	2347	2286	2242	6875	65697
14.	Kasaragod	14870	14326	16940	46136	338	322	340	1000	47136
State		**259106**	**250962**	**325751**	**835819**	**82101**	**79812**	**87192**	**249105**	**1084924**

Source : Directorate of Fisheries, Kerala.

CHAPTER – 4

ATMOSPERE

Atmosphere is composed of air containing Nitrogen, Oxygen, Argon and Carbondioxide constituting 78%, 21%,0.93% and 0.03% respectively. Helium, Methane, Krypton, Hydrogen, Xenon and Ozone constituting the remaining 0.04%. It becomes progressively thinner as its distance from the earth increases with varying temperature gradients.

Environmental factors have emerged as a major cause of global increase in illness and deaths. Most of them are avoidable and the poor population in all countries are the most vulnerable victims.

Atmospheric pollution – main sources

The following are the main sources of atmospheric pollution

a) increasing energy demand and consumption
b) the use of poor quality fuels
c) in-efficient methods of energy production and use
d) increasing number of vehicles
e) traffic congestion
f) poor automobile and road conditions
g) forest fire.

AIR AND TRANSPORT

TABLE – 4.1.1

AVERAGE GASEOUS COMPOSITION OF DRY AIR IN THE TROPOSPHERE

YEAR

Sl. No	GAS	PERCENT BY VOLUME (%)	PARTS PER MILLION (PPM)
1	NITROGEN	78.084000	780840.00
2	OXYGEN	20.950000	209500.00
3	ARGON	00.930000	9300.00
4	CARBONDIOXIDE	00.034500	345.00
5	NEON	00.001800	18.00
6	HELIUM	00.000520	5.20
7	METHANE	00.000140	1.40
8	KRYPTON	00.000100	1.00
9	HYDROGEN	00.000050	0.50
10	XENON	00.000009	0.09
11	OZONE	Variable	Variable

Source: Ministery of environment andForest, Compendium of Environment Statistics-2001, Govt. of India.

TABLE – 4.1.2

AIR QUALITY LEVELS IN SELECTED LOCATIONS OF KERALA

Pollution Standards	Annual Mean Concentration Range ($\mu g/m^3$)					
	SO_2		NO_2		SPM	
	Industrial	Residential	Industrial	Residential	Industrial	Residential
Low (L)	0 – 40	0 – 30	0 – 40	0 – 30	0 – 180	0 – 70
Moderate(M)	40 – 80	30 – 60	40 – 80	30 – 60	180 – 360	70 – 140
High (H)	80 - 120	60 – 90	80 – 120	60 – 90	360 – 540	140 – 210
Critical (C) Pollution level	> 120	> 90	> 120	> 90	> 540	> 210
Locations						
Kochi	L	L	L	L	L	H
Kottayam	L	L	L	L	L	L
Kozhikode	L	L	L	L	L	M
Thiruvananthapuram	L	L	L	L	L	M

Source: Economic Review 2003

Table : 4.1.3

National ambient air quality standards
E (P) Rules, Schl.-VII.GSR 176(E) dt. 2.4.96

Pollutant	Time weighted average	Concentration in ambient air, µg*/m^3			Method of Measurement.
		Industrial area	Residential, rural & other areas	Sensitive area	
Sulphur dioxide (SO_2)	Annual Av.** 24 hours***	80 120	60 80	15 30	1. Improved West and Gaeke method 2. Ultraviolet fluorescence.
Oxides of nitrogen as NO_2	Annual Av.** 24 hours ***	80 120	60 80	15 30	1. Jacob & Hochheiser modified (Na Arsenite) Method. 2. Gas Phase chemi-luminescence.
Suspended particulate matter (SPM)	Annual Av.** 24 hours ***	360 500	140 200	70 100	High volume sampler (Average flow rate not less than 1.1 m^3/minute)
Respirable particulate matter (size less than 10µm)	Annual Av.** 24 hours ***	120 150	60 100	50 75	Respirable particulate matter sampler
Lead (Pb)	Annual Av.** 24 hours ***	1.0 1.5	0.75 1.00	0.50 0.75	AAS Method after sampling using EPM 2000 or equivalent filter paper.
Carbon monoxide (CO). mg/m^3	8 hours*** 1 hour	5.0 10.0	2.0 4.0	1.0 2.0	Non-disbersive infrared spectroscopy

* *Except in the case of carbon monoxide*
** *Annual Arithmetic mean of minimum 104 measurements in a year. These are 24 hourly measurements, taken twice a week, at uniform interval.*
*** *24 hourly/8hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.*

Table : 4.1.4

STATE AMBIENT AIR QUALITY IN SELECTED CITIES OF THE STATE FOR THE PERIOD FROM AUGUST 2002 TO MAY 2003

Sl. No	Name of Station	Type	Parameters monitored	Range (24 Hour Average)		Permissible Limits (µg/m3)	Number of times exceeding the limit
				Min (µg/m3)	Max (µg/m3)		
1	Hi-Tech, Chackai, Veli, Thiruvananthapuram	I	SO2	7.218	22.22	120	-
			NOX	11.25	20.133	120	-
			RSPM	72.28	186.88	150	9 (79)
2	SMV School, Thiruvananthapuram	C	SO2	3.053	20.83	120	-
			NOX	10.27	18.607	120	-
			RSPM	76.367	167.67	150	4 (79)
3	Sasthamangalam, Thiruvananthapuram	R	SO2	3.61	19.44	80	-
			NOX	9.993	18.883	80	-
			RSPM	76.387	145.73	100	1 (85)
4	Kottayam, Kottayam	C	SO2	0.3	0.3	120	-
			NOX	5.8	16	120	-
			RSPM	14.87	222.17	150	5- (80)
5	Vadavathoor, Kottayam	I	SO2	0.3	0.3	120	-
			NOX	5.1	8.4	120	-
			RSPM	3.33	249.07	150	4 (80)
6	Ernakulam South, Ernakulam	C	SO2	3	19.2	120	-
			NOX	1.2	27.16	120	-
			RSPM	15	185	150	3 (76)
			SPM	52	269	500	-

Table : 4.1.4 Contd..

Sl. No	Name of Station	Type	Parameters monitored	Range (24 Hour Average)		Permissible Limits (µg/m3)	Number of times exceeding the limit
				Min (µg/m3)	Max (µg/m3)		
7	Eloor, Cochin, Ernakulam	I	SO2	3	121.5	120	-
			NOX	1.2	38.1	120	-
			RSPM	22	154	150	3 (52)
			SPM	70	354	500	-
8	Irumpanam, Cochin, Ernakulam	I	SO2	3	28.8	120	-
			NOX	1.2	50.5	120	-
			RSPM	13	219	150	4 (76)
			SPM	47	298	500	-
9	Carborundum Universal,Kanjikode, Palakkad	I	SO2	0.222	15.011	120	-
			NOX	0.31	53.136	120	-
			RSPM	21.944	69.167	150	-
			SPM	143.125	258.75	500	- (100)
10	Kozhikkode City, Kozhikkode	C	SO2	0.65	4.138	120	-
			NOX	0.763	11.463	120	-
			RSPM	11.057	21.851	150	-
			SPM	37.646	162.06	500	- (82)
11	Nallalam, Kozhikkode	I	SO2	0.625	6.7797	120	-
			NOX	0.295	108.8267	120	-
			RSPM	11.56	40.393	150	-
			SPM	48.611	322.15	500	- (86)

Table : 4.1.4

AMBIENT AIR QUALITY STATUS IN SELECTED CITIES/TOWNS

FOR THE PERIOD FROM 18.08.2003 TO 18.03.2004

Sl. No	City	Type	Parameters monitored	Range (24 Hour Average)		Permissible Limits (µg/m3)	Number of times exceeding the limit
				Min (µg/m3)	Max (µg/m3)		
1	Thiruvananthapuram	C	SO2	4.68	14.56	80	-
			NOX	12.3	33.28	80	-
			RSPM	63.0	197.0	100	58 (61)
			SPM	66.0	206.0	200	1(61)
2	Ernakulam	C	SO2	0.77	27.31	80	-
			NOX	2.98	28.17	80	-
			RSPM	24.0	122.0	100	2 (62)
			SPM	61.0	186.0	200	-
3	Kozhikode	C	SO2	0.625	4.792	80	-
			NOX	0.417	37.028	80	-
			RSPM	10.4	119.306	100	4 (58)
			SPM	29.315	168.24	200	-

TABLE – 4.1.5

NUMBER OF MOTOR VEHICLES HAVING VALID REGISTRATION IN KERALA

Year	Good Vehicles	Buses	Taxi Cars	Motor Car	Auto Rickshaws	Tractors	Jeeps	Motor Cycles	Others	Total
1970-71	13162	6563	8848	33294	1062	2046	4828	15117	1314	86234
1975-76	15882	8268	11582	40667	3734	3594	6420	26110	1819	118076
1980-81	24682	9159	18890	56802	9640	1853	7834	59539	6206	194597
1985-86	45325	16449	30201	82222	30537	3268	14721	130992	7902	361617
1990-91	66190	21454	37530	125769	67317	4305	26133	288498	10426	647742
1991-92	71089	22833	36999	129232	75244	4573	27302	330316	10584	708172
1992-93	77336	25245	40931	135299	83725	4315	29334	369537	15573	781395
1993-94	88455	30370	49843	144400	92296	4691	32563	428641	16413	887672
1994-95	100252	34862	54681	155150	103465	5045	37774	496873	17820	1005922
1995-96	111762	38177	57482	171801	127913	5296	44639	591923	21248	1170241
1996-97	131311	43030		191957	148902	5485	65091	694242	77507	1357825
1997-98	139145	55482	50604	212670	164834	5567	67329	798982	13425	1508038
1998-99	151082	48884	59724	228824	197595	5801	82416	904961	29651	1708938
1999-00	163443	58888	71581	257796	227895	7782	67497	1020797	34558	1910237
2000-01	173856	65681	75628	282996	248350	8177	69261	1151735	36201	2111885
2001-02	52176	71966	82236	305887	265767	8459	70212	1289035	37734	2315372
2002-03	195363	79713	88070	336583	285092	8700	70864	1449283	38503	2552171

Source: Economic Review 2002 &2003

TABLE – 4.1.6

MAJOR INDICATORS SHOWING OPERATIONAL EFFICIENCY OF KSRTC

SL NO	ITEMS	YEAR		INCREASE/ DECREASE
		2001-02	2002-03	
1.	Fleet strength (Nos)	4421	4260	-3.64
2.	Gross revenue earnings (Rs. in crores)	605.31	647.31	+6.94
3.	Gross revenue expenditure (Rs. in crores)	712.06	777.35	+9.17
4.	Gross operating loss (Rs. in crores)	106.75	130.04	+21.82
5.	No. of schedules operated as on 31st march 2003 (Nos)	3576	3651	+2.10
6.	Average earnings per vehicle on road per days (Rs)	4119	5264	+27.8
7.	Average earnings per Km. of bus operated (Paise)	1204	1570	+30.40
8.	Average earnings per passenger (Paise)	512	591	+15.43
9.	Average route length (Kms)	57.00	50.01	-12.26
10	Average Kms. run per bus per daay	340	335	-1.47
11.	Average number of buses held daily (Nos.)	4402	4338	-1.45
12.	Passengers carried (Lakhs)	11087.16	11096.76	+0.09

Source: Economic Review 2003.

Table : 4.1.7

EMISSION LIMITS FOR DIESEL DRIVEN VEHICLES

Test Method	Maximum smoke density		
	Light absorption co-efficient (M)	Bosch Unit	Hartridge Unit
Full load at a speed of 60% to 70% of maximum engine rated speed declared by the manufacturer.	3.1	5.2	75
Free Acceleration	2.3		65

Table : 4.1.8

Specification of Diesel
E(P)Rules, Schl.-VI.GSR 176(E)dt.2.4.96

SL. No.	Characteristics	Requirement	Method of Test Page of IS:1448
1.	Density at 15°C, kg/m³	820 to 880*	P : 32
2.	Cetane number, min.	45.0**	P : 9
3.	Distillation		
	85 percent by volume recovery at °C, max	350	P : 18
	95 percent by volume recovery at °C, max	370	
4.	Sulphur, percent by mass, max.	0.50 ***	P : 33

** 820 to 860 by 2000 AD*
*** 48 by 31st December, 1998 (except in Digboi, Gauhati and Bangaigaon Refineries)*
**** (1) 0.50 percent by mass by 1st April 1996 in four metros and Taj Trapezium;*
(2) 0.25 percent by mass by 1st October, 1996 in Taj Trapezium
(3) 0.25 percent by mass by 1st April 1999 throughout the country.

Note:

(a) Above specifications apply to HSD only.
(b) For new refineries coming up during or after 1997 specification applicable by the year 2000 for existing refineries shall be applicable by 1997.

- *Number within bracket, in all cases, is the serial number in the Notification of the Government of India.*

ENERGY:

The growth of power system in Kerala shows that development was mainly focussed on tapping hydropower potential. Hydropower is renewable, non-polluting and economic. The lion's share of energy requirement of the state was being met, till recent past, by the generation from the 20 hydropower plants of the Kerala State Electricity Board.

TABLE – 4.2.1

INSTALLED GENERATION CAPACITIES OF UTILITIES AS ON 25/01/2004

UNIT: MW

STATE	HYDRO			THERMAL	WIND	TOTAL
	KSEB	PRIVATE	TOTAL			
KERALA	1807.6	33.0	1840.600	771.616	2.025	2614.241

TABLE – 4.2.2

KERALA POWER SYSTEM

SL NO	ITEM	AS ON 31.03.2002
1.	Installed Capacity	2602
2.	Maximum System Demand (MW)	2348
3.	Generation per annum (MU)	8850
4.	Import per annum (MU)	3845
5.	Energy available for sale pa(within the state) (MU)	12593
6.	No of EHT substations	194
7.	Per Capita consumption (KWH)	312
8.	No. of Villages Electrified	1384
9.	Total number of Villages	1384
10.	Number of Consumers in lakhs	67
11.	Connected load (MW)	8625

TABLE – 4.2.3
ACTUAL POWER SUPPLY POSITION IN KERALA

(All figures in MU net)

STATE	April 1999 to March 2000				April 2000 to March 2001			
	Requirement	Availability	Shortage	Shortage %	Requirement	Availability	Shortage	Shortage %
KERALA	12850	11908	942	7.3	13564	12670	894	6.6
ALL INDIA	480430.0	450607.90	29822.10	6.2	507213.10	467401.30	39811.80	7.8

SOURCE: Compendium of Environment Statistics, 2001,Government of India.

TABLE – 4.2.4

CONSUMPTION OF FOSSIL FUELS FOR ELECTRICITY GENERATION FROM THERMAL STATIONS
(BY KIND OF FUELS) KERALA DURING 1999 – 2000 (GAS & DIESEL)

STATE	GAS STATIONS				DIESEL STATIONS		
	Natural Gas (M.Cu.Mts)	HSD (Kilo Litres)	Naphtha (Kilo Litres)	Generation (GWH)	Diesel Oil (Kilo litres)	Generation (GWH)	Average oil consumed (Lts/Kwh)
KERALA	0	0	0	0	52761	251.28	0.21
ALL INDIA	9005	209295	649696	41311.63	270674	1303.66	0.21

SOURCE: Compendium of Environment Statistics, 2001. Government of India.

TABLE – 4.2.5
PERCENTAGE OF HOUSE HOLDS USING DIFFERENT FUELS FOR COOKING
(CENSUS 1991)

STATE	Cow dung cake	Electricity	Coal/Coke	Charcoal	Cooking Gas	Wood	Biogas	Kerosene
KERALA	0.06	0.12	0.02	0.01	4.86	92.42	0.21	1.47
ALL INDIA	15.39	0.31	3.47	0.77	7.94	61.50	0.49	7.16

SOURCE: Compendium of Environment Statistics, 2001. Government of India.

TABLE – 4.2.6

BIO-MASS AVAILABILITY IN KERALA

Sl No	Type of Bio-Mass	Total Bio-Mass Production	Potential Bio-Mass Availability For Power Generation (million tones)	Power generation potential (mw)
1.	Coconut Fronds	5.04	2.52 (0.50)	302.5
2.	Tapioca stalk	2.02	1.42 (0.70)	198.3
3.	Coconut Shell	1.14	0.91 (0.80)	127.9
4.	Areca nut Fronds	0.16	0.06 (0.35)	8.1
5.	Cashew nut stalk	0.10	0.02 (0.20)	2.8
Total		**8.46**	**4.93 (0.58)**	**639.6**

Source : Economic Review 2003.

INDUSTRIES

Kerala is an industrially backward state in the country with low manufacturing activity. The state has only 589 medium and large industries, prominent among them being in public sector. The number of state level public-sector units stands at 111. Besides there are 19 central units. The state is still known for traditional industries like handloom, coir, cashew, handicrafts etc., which are more labour-intensive.

GREEN HOUSE GAS EMISSION

Carbon di-oxide emission mainly occurred due to the energy production and use, which causes Green House Gas emission. Air pollution is large in urban areas where the vehicles are the major contributors. Industries also cause air pollution.

TABLE – 4.3.1

DISTRICT-WISE DISTRIBUTION OF REGISTERED WORKING FACTORIES IN KERALA FROM 1990 TO 2002

Sl No	District	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1.	Thiruvananthapuram	655	606	712	864	855	809	850	868	892	923	898	897	901
2.	Kollam	1179	1188	1415	1440	1425	1498	1654	1735	1787	1899	1927	1905	1908
3.	Pathanamthitta	292	586	329	366	442	363	382	430	470	498	526	532	534
4.	Alappuzha	750	802	901	921	1098	1024	1059	1111	1140	1194	1211	1213	1218
5.	Kottayam	963	799	1098	1127	1126	1180	1247	1283	1293	1302	1294	1297	1301
6.	Idukki	278	289	292	302	251	290	303	305	303	341	325	326	325
7.	Ernakulam	1931	1933	2274	2299	2294	2364	2543	2686	2700	2924	2931	2937	2946
8.	Thrissur	1692	1591	1939	1986	1987	1944	2084	2188	2364	2547	2557	2559	2563
9.	Palakkad	1220	1330	1574	1638	1692	1620	1774	1972	1966	2028	1993	1975	1980
10.	Malappuram	672	650	816	856	857	815	894	912	924	963	995	1003	1008
11.	Wayanad	122	125	129	126	128	128	151	180	176	139	140	141	142
12.	Kozhikode	1386	1981	1565	1635	1703	1582	1656	1778	1777	1749	1764	1768	1770
13.	Kannur	1137	1182	1359	1369	1296	1473	1579	1614	1636	1738	1716	1729	1734
14.	Kasaragod	171	193	205	203	151	241	258	274	291	259	267	272	272
TOTAL		**12448**	**13255**	**14608**	**15132**	**15305**	**15331**	**16434**	**17336**	**17719**	**18504**	**18544**	**18554**	**18602**

Source: Economic Review –2003.

Compendium of Environment Statistics

TABLE – 4.3.2

INDEX OF INDUSTRIAL PRODUCTION 2000-2001 & 2001 – 2002

BASE = 100 for the year 1980-81.

SL NO	ITEM	WEIGHT	INDEX FOR	
			2000-2001	*2001-2002*
	GENERAL	100.00	360.20	302.29
1.	Manufacture of Food Products	8.82	143.990	119.181
2.	Manufacture of beverages, tobacco and related products	1.46	128.195	191.497
3.	Manufacture of Cotton Textiles	8.02	135.923	151.688
4.	Manufacture of wool, silk and man made fiber textiles	1.26	72.496	33.054
5.	Manufacture of Textile Products	3.26	17.134	17.207
6.	Manufacture of wood and wood products	1.35	43.781	31.521
7.	Manufacture of Paper and Paper products	3.16	0.000	0.000
8.	Manufacture of basic chemicals and chemical products (Except Petroleum and Coal)	19.78	308.943	426.998
9.	Manufacture of rubber, plastic, petroleum and coal products and processing of unclear fuels.	10.06	193.725	177.996
10	Manufacture of non-metallic mineral products	3.42	175.005	267.228
11.	Basic metals and Alloy Industries	3.43	92.422	79.944
12.	Manufacture of metal products and parts except machinery and equipment	0.50	787.536	660.355
13.	Manufacture of Machinery and equipments other than transport equipment	9.46	2066.235	1226.269
14.	Manufacture of transport equipment and parts	2.67	9.019	9.820
15.	Other manufacturing Industries	1.42	39.883	28.650
16.	Electricity generation, transmission and distribution.	21.93	194.694	187.811

Source: Economic Review-2003.

Table : 4.3.3
Effluent standards for Sugar Industry

Sl.No.	Parameter	Unit	Limit	
			In land surface water	Land for irrigation
1	Suspended solids	Mg/l, max.	30	100
2	B.O.D. (3 days at 27°C)	"	30	100
Waste water generation		*m^3/t of cane crushed, max.*	*0.4*	

Table : 4.3.4
Effluent standards for Large Pulp and Paper Industries
(Large pulp & npaper/Newsprint/Rayon grade pulp plants of capacity above 24000 tonne/ annum)

Sl. No.	Parameter	Unit	Limit
1	PH		7-8.5
2	Suspended Solids	Mg/l, max.	50
3	B.O.D. (3 days at 27°C)	"	30
4	C.O.D.	"	350
5	Total Organic Chlorine	Kg/t of product, max.	2
Waste water generation		*m^3/t of product, max.*	
Pulp & Paper		*175*	
Newsprint/Rayon grade pulp		*150*	

Table : 4.3.5
Effluent standards for Oil Refineries

Sl. No.	Parameter	Unit	Limit	Kg/1000t of crude
1	pH		6 to 8.5	
2	Oil and grease	Mg/l, max.	10	7
3	Phenols (as C_6H_5OH)	"	1	0.7
4	Sulphides (as S)	"	0.5	0.35
5	B.O.D. (3 days at 27°C)	"	15	10.5
6	Suspended Solids	"	20	14

Table : 4.3.6
Effluent standards for Aluminium Industry*

Extrusion

Sl. No.	Parameter	Unit	Limit
1	pH		5.5-9
2	Suspended Solids	Mg/l, max.	100
3	Shall not exceed 5°C above the receiving water temperature		

Smelter

Sl. No.	Parameter	Unit	Limit
1	pH		6.5-8.5
2	Suspended Solids	Mg/l, max.	100
3	Oil & Grease	"	10
4	Free Ammonia	"	5
5	Ammoniacal Nitrogen	"	50
6	Flourides	"	2
7	Zinc (as Zn)	"	5
8	Copper (as Cu)	"	3
9	Nickel (as Ni)	"	3
10	Lead (as Pb)	"	0.1
11	Chromium (as Cr)	"	2
12	B.O.D.	"	30

: *General Standards*

Table : 4.3.7
Effluent standards for Petrochemicals (basic and intermediates) Industry

Sl. No.	Parameter	Unit	Limit
1	pH		6.5 to 8.5
2	B.O.D. (3 days at 27°C)	Mg/l, max.	50
3	C.O.D	"	250
4	Phenols (as C_6H_5OH)	"	5
5	Sulphides (as S)	"	2
6	Cyanides (as CN)	"	0.2
7	Flourides (as F)	"	15
8	Hexavalent Chromium (as Cr^{+6})	"	0.1
9	Total Chromium (as Cr)	"	2
10	Total Suspended Solids	"	100

B.O.D. - Biochemical Oxygen Demand
C.O.D. - Chemical Oxygen Demand

NOISE

In Kerala, noise pollution is reaching an alarming level at Kochi, which is the industrial capital of the state. The average day time noise at the District Hospital was 66 dB, which is 16dB higher than the limit. The noise level at Thrikkakara, which is far away from the city, was 10 dB more than the permissible limit during peak hours.

Table : 4.4.1

AMBIENT AIR QUALITY STANDARDS IN RESPECT OF NOISE

Area Code	Category of Area	Limits in dB(A) Leq	
		Day times	Night times
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note:

1. *Day time is reckoned in between 6 a.m. to 9 p.m.*
2. *Night time is reckoned in between 9 p.m. to 6 a.m.*
3. *Silence zone is defined as areas upto 100 meters around such premises as hospitals, educational institutions and courts. The Silence zones are to be declared by the Competent Authority.*
   Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.
4. *Mixed categories of areas should be declared as one of the four above mentioned categories by the Competent Authority and the corresponding standards shall apply.*

CHAPTER – 5

LITHOSPHERE

Land uses

Soil

One of the most valuable gifts of nature to mankind is soil. It is estimated that out of 22.4 lakh hectares of cultivated land in the state around 9 lakh hectare is prone to soil erosion.

Soils of Kerala are briefly classified as

1. soils of hills and uplands
2. soils of central Sahyadri
3. soils of eastern parts of Malapuram and
4. Soils of south Sahyadri.

Table :5.1.1
Selected categories of land use classified (in 00 hectares)

Sl.No	Years	Net sown area A	Gross sown area B	Area sown more than once B – A	Net irrigated area C	Gross irrigated area D	Area irrigated more than once D – C
1	1975-76	21892	29813	7921	-	-	-
2	1980-81	21796	28848	7052	2380	3809	1429
3	1985-86	21910	28666	6756	2963	3992	1029
4	1990-91	22468	30200	7732	3334	3846	512
5	1991-92	22480	30211	7731	[illegible]	[illegible]	[illegible]
6	1992-93	[illegible]	[illegible]	7969	3345	3764	419
7	1993-94	22381	30427	8046	3236	2808	428
8	1994-95	22395	30483	8088	3580	5063	1483
9	1995-96	22468	30672	8024	3422	4655	1233
10	1996-97	22686	30212	7526	3569	4586	1017
11	1197-98	22706	29690	6984	3505	4171	666
12	1998-99	22587	29165	6578	3745	4208	463
13	1999-00	22394	30017	7623	3800	4707	907
14	2000-01	22061	30216	8155	3810	4579	769
15	2001-02	21907	29923	8016	3772	4322	550
16	2002-03	22045	30282	8237	3932	4475	543

Water-sheds

Soil and water conservation activities in the watersheds of the state received much attention during the Ninth five-year plan. Watershed based interventions has a direct effect on soil moisture recharge. During 2002-03 under RIDFI, 37 watersheds in the five districts of Thiruvanthapuram, Idukki, Wayanad, Kannur and Kasargode were completed by benefiting an area of 5718 hectares.

River valley project.

River valley project- Kabani is a centrally sponsored interstate scheme of Kerala and Kavintaka started in the year 1998 being implemented in the catchment of Kabani river (Kerala portion) which originates from Kerala state. The major portion of the catchments of Kabani (Kerala portion) is spread over Wayanad district. which comes under high altitude zone of Kerala. An integrated watershed management approach is being adopted in this project.

Table:5.1.2

Information on Priority watersheds of river valley projects/flood prone river catchments of Kerala

(Area in lakh hectares)

Total area	Surveyed area	Total SWS/MWS	Very high		High		Total priority	
			SWS/MWS	Area	SWS/MWS	Area	SWS/MWS	Area
2.86	2.86	106 + 11(P)	25	0.48	28	1.10	53	1.58

Source: Compendium of Environment Statistics. 2001

SWS – Sub WaterShed, MWS - Micro Water Shed, P - Partly

Table : 5.1.3

Information on soils of priority watersheds of river valley projects/flood prone river catchments of Kerala

(Area in lakh hectares)

Catchment area	Surveyed area	Priority area	Subwatershed area on which reports available
2.86	2.86	1.58	0.88

Source: Compendium of Environment Statistics, 2001

Wet Lands

Wet lands in Kerala include estuaries, deltas, mangroves, coastal lagoons, freshwater lakes, swamp forests, rivers, streams, ponds and non-managed systems - such as rice fields and reservoirs.

Kole wet land is one of the largest and most important wetland of Kerala, covering an area of 13.632 hectares, spread over Thrissur and Malapuram district. *Kole* wet lands now face serious problems such as reclamation of land and change in land use pattern. The indiscriminate use of pesticide has been found to affect the migrant bird population, which visit Kerala wet lands from September to April every year. *Kole* wetlands harbour globally threatened species such as spot-headed pelicans, oriental darter, black headed ibis, painted stork, black necked stork, black bellied tern, cinereous vulture and greater spotted eagle. From bio-diversity conservation point of view *Kole* is of at-most importance.

Sasthankottah, Vembanad and Astamudi are the notified wet lands in the state. Ashtamudi estuary is the second largest estuary in Kerala.

Features of Ashtamudi Estuary:

Dissolved oxygen is low in the Ashtamudi. It is 3.2mg/l in the non-monsoon compared to the value of about 5mg /l in a healthy tropical estuary. Low levels of 2-3 mg/l occur in the southern *kayal* adjacent to Kollam city.

Chemical pollution of water is not high except in certain pockets.

Microbial contamination is high in some locations particularly around the port area and in the river zone.

The southern *kayal* is affected by the waste disposal of the *coir* industry which causes a large increase in the sediment organic content.

Fleshing of the *kayal* is slow and so discharges in the water body need to be minimized. Polluting hydrocarbon content is highest in the fishing harbour area and along the national waterway.

Source: CESS

Table : 5.1.4

Distribution of wet lands in Kerala.

	Natural	Manmade
Number	32	2121
Area	24,329 hectares	210,579 hectares

Notified wet lands in Kerala	Ashtamudi	5071.07 hectares	Water spread post monsoon
	Sasthamkotta	354.69 hectares	Water spread post monsoon

MANGROVES AND SACRED GROVES

In Kerala mangrove formations are confined to mainly Kasrgode, Kannur, Kozhikode, Malapuram, Ernakulam, Kottayam, Alapuzha, Kollam and Triruvanthapuram districts in scattered bits.

There are 14 true mangrove species in Kerala mostly belonging to Aegiceras, Avicenia, Brugiera, Ceriops, Kandela and Rhizophora.

In Kerala, as a part of culture, sacred groves (Kavu) is protected and preserved to a certain extent.

MANGROVE ECO SYSTEMS IN KERALA	Area : 1924 hectares.

AGRICULTURE

Data regarding the area under cultivation of important crops in Kerala shows that Paddy witnesed a steep decline of 5 lakh hectares during the last two decaades.

Coconut -a pernnial crop and oil crop of the state- covering an area of 9 hecatres, occupies 41 percent of the net cropped area. The state continues to enjoy a near monopoly in area under cultivation of pepper (95%) in the country. Area under the crop cashew-nut in Kerala has been declining from 1.25 lakh hectare in 1988-89 to 0.87 lakh hectare in 2002-03.

The state's share of plantation crops like rubber, tea coffe and cardomon is 6.40 lakh hecatre accounting for 29% of the net cropped area and 43% of the area under these crops in the country.

Vegetable & Fruit promotion Council's Programme.

It is the successor organisation of Kerala Horticulture Development Programme.

Kissan Kerala

It is a television based agricultural dissemination system which is aimed to propagate information of regional relevance regarding best farming practises, soil and water conservation, forcast and precaution on pest and disease incidence, weather and marked information etc., in an interactive mode

TABLE – 5.2.1

USE OF AGRICULTURAL INPUTS

SL. NO	PROGRAMME	UNIT	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
1.	Consumption of chemical Fertilisers	'000' Tonnes										
	1 Nitrogen	"	76.97	80.18	87.23	86.39	86.96	86	87.06	73.76	76.42	86.7
	2 Phospharous	"	33.12	39.94	43.14	41.44	45.23	42.5	43.98	37.60	37.24	40.2
	3 Potassium	"	65.11	78.21	73.52	59.75	87.30	52.9	80.32	61.85	63.47	77.8
	TOTAL	"	175.20	198.33	203.89	187.58	219.49	181.5	211.36	173.21	177.13	204.7
2.	Consumption of pesticides (Technical Grade Material)	Tonnes										
	1 Fungicide	"	264.5	1038.92	1001.88	895.92	359.91	839.53	472.41	497.36	608.40	343.58
	2 Insecticides	"	294.64	305.67	249.37	218.41	192.16	232.51	467	144.64	568.29	918.38
	3 Weedicide	"	20.46	16.63	12.76	15.74	31.13	70.62	108.27	98.41	142.79	97.67
	4 Rodenticides	"	21.10	20.12	18.74	10.40	13.19	8.9	10.24	7.33	8.63	17.11
	TOTAL	"	600.7	1381.34	1282.75	1140.47	596.39	1151.56	1057.92	747.74	1328.11	1376.74
3.	Area Under High Yielding Varieties	Ha										
	1 Paddy	Ha	172418	174445	163876	153329	168679	177098	210990	226687	222088	250804

Source: Directorate of Agriculture

TABLE – 5.2.2

PERFORMANCE OF CROP PRODUCTION

Unit : Tonnes

SL NO	CROPS	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03
1.	RICE	1003938	975065	953026	871361	764610	726743	770686	751328	703504	688859
2.	PULSES	15322	14527	14994	13674	11668	9822	8571	5472	6281	5548
3.	PEPPER	49845	59256	68568	56546	46040	68510	47543	60929	58240	59744
4.	GINGER	37676	49748	46455	46371	43617	39362	41344	42699	40181	39886
5.	TURMERIC	6296	9283	9559	9840	8585	8034	8362	9037	7895	7598
6.	CARDAMOM	4430	4720	5380	4550	5290	4990	6585	7580	8380	6480
7.	ARECANUT*	15357	17466	17429	17175	87038	68479	83337	87947	84681	92039
8.	BANANA	339994	342006	362917	403673	436717	386588	398145	327955	375903	379884
9.	OTHER PLANTAINS	233674	232258	229493	338871	356622	397986	410566	403695	393182	408649
10.	CASHEWNUT	79925	95548	82760	68963	56885	51336	65547	66178	65867	63287
11.	TAPIOCA	2602212	2344238	2500113	2691118	2741696	2630155	2531752	2586903	2455880	2504391
12.	COCONUT(million nut)	5192	5336	5155	5276	5210	5132	5680	5536	5479	5338
13.	COFFEE	46240	46240	45000	47320	48300	61150	60470	70550	66690	64425
14.	TEA	61488	60715	64802	69319	72667	68373	61955	69132	66090	65800
15.	RUBBER	408311	442830	474555	512756	541935	559099	572820	579866	580350	594917

* Before 1997-98 unit is million nuts and after unit is tonnes.

Source: Directorate of Economics and Statistics, Kerala.

TABLE – 5.2.3

AREA UNDER PRINCIPAL CROPS

Unit : Hectares

SL NO	CROPS	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03
1.	RICE	507832	503290	471150	430826	387122	352631	349774	347455	322368	310521
2.	PULSES	20874	20097	20990	18299	15078	12627	10985	6986	8191	7357
3.	PEPPER	184410	186720	191596	182887	180370	182384	198406	202133	203956	201037
4.	GINGER	11125	13866	12925	13199	12352	11107	11264	11612	10706	10365
5.	TURMERIC	3250	3938	3968	4053	3586	3706	3971	4127	3558	3388
6.	CARDAMOM	43456	44237	44245	41268	40867	41449	41491	41288	41336	44237
7.	ARECANUT	69153	71676	70899	76066	73351	73639	81941	87360	93193	92589
8.	BANANA	23850	25151	26267	28855	31001	30521	39046	45059	50871	51805
9.	OTHER PLANTAINS	48298	47415	46594	49224	49639	50947	53252	54353	55183	55412
10.	CASHEWNUT	106733	103451	103284	97089	94689	91268	89403	92122	89718	86623
11.	TAPIOCA	130987	114289	113601	120387	121389	112774	111922	114609	111189	110297
12.	COCONUT	882293	910963	914370	902104	884344	882288	925035	925783	905718	905482
13.	COFFEE	82348	82348	82348	83014	83014	83699	84139	84735	84795	84139
14.	TEA	34793	34745	34605	34602	34602	34690	34793	36847	36899	36821
15.	RUBBER	437100	443300	448988	455566	465282	469924	472900	474364	475039	476047

Source: Directorate of Economics and Statistics, Kerala.

TABLE – 5.2.4

SEED REPLACEMENT RATE IN PERCENTAGE

SL. NO	CROP	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03
1.	PADDY	10	10	10	10	10	10
2.	PULSES	20	20	20	20	20	20
3.	GROUNDNUT	10	10	10	10	10	10
4.	SESAMUM	20	20	20	20	20	20

Source : Zonal Seed Conference Kharif: 1997-2003

Table : 5.2.5

USE OF AGRICULTURAL INPUTS

SL. NO	PROGRAMME	UNIT	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03
1.	Consumption of chemical Fertilisers	'000' Tonnes										
	1 Nitrogen	"	76.97	80.18	87.23	86.39	86.96	86	87.06	73.76	76.42	86.7
	2 Phosphatic	"	33.12	39.94	43.14	41.44	45.23	42.5	43.98	37.67	37.24	40.2
	3 Potassic	"	65.11	78.21	73.52	59.75	87.30	52.9	80.32	61.85	63.47	77.8
	TOTAL	"	175.20	198.33	203.89	187.58	219.49	181.5	211.36	173.21	177.13	204.7
2.	Consumption of pesticides (Technical Grade Material)	MTS										
	1 Fungicide	"					359.91	839.53	472.41	497.36	608.40	343.58
	2 Insecticides	"					192.16	232.51	467	144.64	568.29	918.38
	3 Weedicide	"					31.13	70.62	108.27	98.41	142.79	97.67
	4 Rodenticides	"					13.19	8.9	10.24	7.33	8.63	17.11
	TOTAL	"					596.39	1151.56	1057.92	747.74	1328.11	1376.74
3.	Area Under High Yielding Varieties	Ha										
	1 Paddy	Ha	172418	174445	163876	153329	168679	177098	210990	226687	222088	

Source Statistics for Planning 2001 & Economic Review –2002

Table : 5.2.6
DISTRIBUTION OF CERTIFIED SEEDS

UNIT: Qtls

SL No	CROP	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04*
1.	PADDY	24423.65	25383.1	30883.1						106075
2.	PULSES	1447	1295	2942	1891	1822	1620	1626	1578	287
3.	OILSEEDS									
	1 Groundnut			3770	1893	2481	1820	2353	2144	195
	2 Sesamum			120	120	120	80	80	80	11
	TOTAL									

Source: ZONAL SEED CONFERENCE KHARIF: 1997-2003

Table : 5.2.7 - A

LAND UTILISATION PATTERN IN KERALA

(Area in 100 hectares)

Sl. No	Classifications	1975 - 76	1980-81	1985-86	1990-91	1991-92	1992-93	1993 -94
1	**Total geographical area**	38855	38855	38855	38855	38855	38855	38855
2	Forests	10815	10815	10815	10815	10815	10815	10815
3	Land put in non agricultural use	2592	2698	2786	2974	3014	3028	3084
4	Barren and uncultivable land	785	858	831	583	551	552	515
5	Permanent pastures and other grazing land	199	54	42	19	18	17	16
6	Land under miscellaneous tree crops, not included in net area sown	842	639	502	344	343	341	367
7	Cultivable waste	1134	1290	1256	946	928	912	898
8	Fallow land other than current fallow	230	269	280	264	267	274	287
9	Current fallow	366	436	432	442	439	420	492
10	Net area sown	21892	21796	21910	22468	22480	22496	22381
11	Area sown more than once	7921	7052	6756	7732	7731	7969	8046
12	Total cropped area	29813	28848	28666	30200	30211	30465	30427
13	Cropping intensity	NA	NA	NA	NA	NA	NA	NA

Table : 5.2.7 - B

LAND UTILISATION PATTERN IN KERALA

(Area in hectares)

Sl. No	Classifications	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03
1	Total geographical area	3885500	3885500	3885500	3885497	3885497	3885497	3885497	3885497	3885497
2	Forests	1081500	1081500	1081500	1081500	1081509	1081509	1081509	1081509	1081509
3	Land put in non agricultural use	322800	313100	317900	3320300	333822	354390	381873.	392352	376751
4	Barren and uncultivable land	48400	43200	41000	38900	28341	28884	29318	29728	29778
5	Permanent pastures and other grazing land	1500	1200	900	800	682	253	164	233	451
6	Land under miscellaneous tree crops, not included in net area sown	32400	26900	23300	22000	20200	18515	15409	13613	5186
7	Cultivable waste	82400	74400	67400	65100	62710	58297	59257	63771	75010
8	Fallow land other than current fallow	29100	29100	29300	27700	31537	32138	33988	34331	41762
9	Current fallow	47800	51300	55500	58500	68022	72166	77853	79270	70498
10	Net area sown	2239500	2246800	2268600	2270600	2258674	2239363	2206126	2190690	2204552
11	Area sown more than once	808800	8024400	752600	698400	657831	762341	815556	801562	823671
12	Total cropped area	3048300	3067200	3021200	2969000	2916505	3001704	3021682	2992252	3028223
13	Cropping intensity	NA	NA	NA	NA	NA	134	137	137	137

WASTELANDS IN KERALA

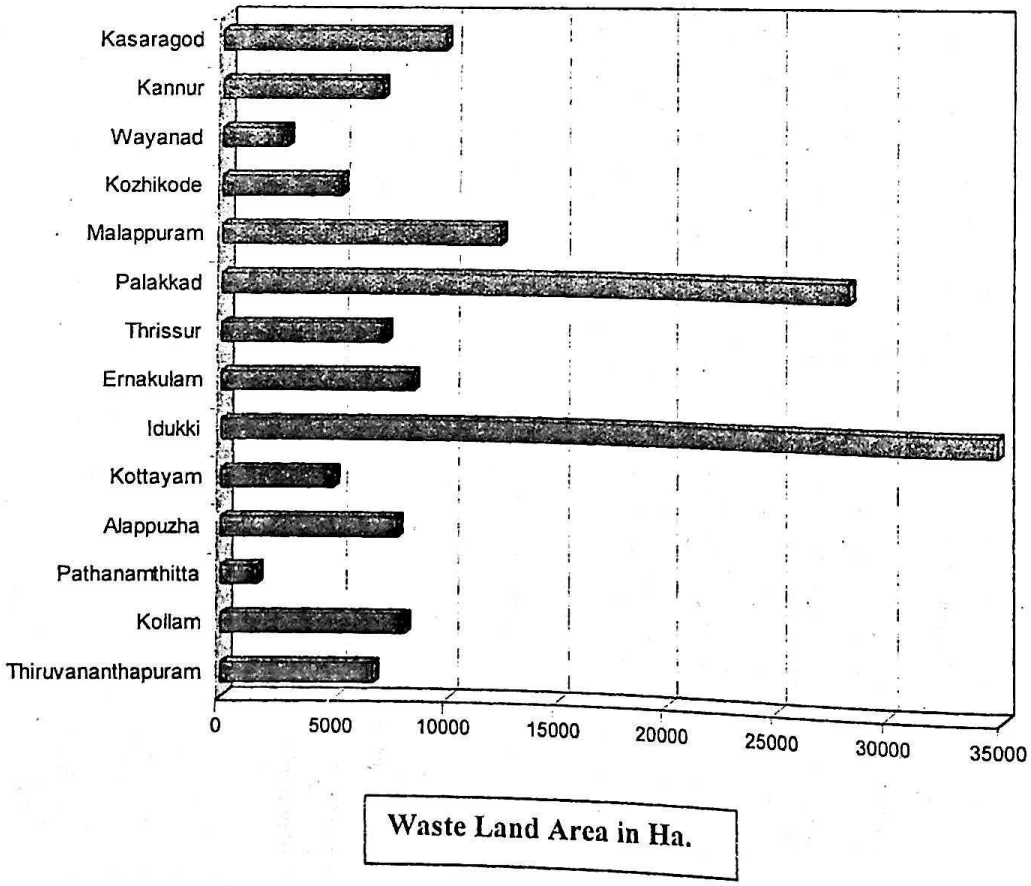
Table : 5.3.1

District wise area under wasteland

(In Ha.)

SI.NO	DISTRICT	WASTELAND AREA
1.	Thiruvananthapuram	6658
2.	Kollam	8072
3.	Pathanamthitta	1550
4.	Alappuzha	7731
5.	Kottayam	4880
6.	Idukki	34813
7.	Ernakulam	8454
8.	Thrissur	7198
9.	Palakkad	28356
10.	Malappuram	12367
11.	Kozhikode	5184
12.	Wayanad	2761
13.	Kannur	6980
14.	Kasaragod	9814
KERALA		144818

CHART : WASTELANDS IN KERALA



NATURAL DISATERS

Table 5. 4.1

Damage due to heavy rains, flood and cyclone during the South West Monsoon in Kerala (as on 28.01.2000)

Items	Period of occurrence	Calamity*	Nos
Total districts	25 May to 8 Oct 1999	HR/F	14
Village affected	25 May to 8 Oct 1999	HR/F	1368
Damage to houses / huts	25 May to 8 Oct 1999	HR/F	20083
Human lives lost	25 May to 8 Oct 1999	HR/F	131

Source : Natural disaster management, Ministry of Agriculture.

F –Flood, L – Landslide HR – Heavy rain.

MINING

The exploratory and prospective division of the Department of Mining and Geology conducted explorations for Kaolinitic clays in Thiruvanthapuram and Kasargode districts. Details are given below.

Table : 5. 5. 1
Different types of Mining

Sl.No	Types	Details
01	Sand Mining a) Neyyar river basin (8 panchayats) b) Periyar river basin (320 land mining locations)	168 Metric tonnes per day. 8372 m^3 /day.
02	Clay mining Neyyar river basin	20% of paddy field
03	Rock mining	249 minor mineral quaries falling in Ernakulam district

Source : Economic Review 2003

Table : 5.5.2

Details of river sand mining from various river basins in greater Kochi Region.

River basin	River length in km	Drainage Area (km^2)	Estimated sand reserve (10^6 m^3)	Panchayats involved in sand mining	Volume of sand extracted 10^6 m^3 /year.	Suitable yield m^3 /year.	No of labourers
1	2	3	4	5	6	7	8
Periyar	244	5398	26.70	15	3.11	50708	7000
Pamba	176	2235	10.62	14	0.40	17883	995
Muvattupuzha	121	1554	7.56	12	0.33	41827	1147
Manimala	90	847	3.18	10	0.47	14200	1300
Chalakudi	130	1704	4.91	5	0.15	7810	1200
Meenachil	78	1272	3.12	-	-	-	-
Achankovil	128	1484	5.80	-	-	-	-

CHAPTER – 6

HYDROSPHERE

WATER

The fresh water availability of Kerala according to the available estimates (1974) is 77.35 billion cubic meters including re-generated flow from ground water. Nearly 40% of available water resources is lost as run off. In Kerala 71% of fresh water withdrawal is for agriculture.

In Kerala it is proposed to organise River Basin Organisations in five major river basis viz. Chaliyar, Bharathapuzha, Periyar, Pamba and Achamkovil RBO's will address the issues of soil conservation, pollution control, flood control, optimum usage of water resources in a river and longterm conservation of rivers.

Government of Kerala has initiated two pilot studies in Neyyar and Malampuzha to operationalise the modalities of implimentation of Participatory Irrigation Management. Water users's Associations will be formed for the O & M of the branch cannals and distributories " Kerala Irrigation and Water Conservation Act 2003" have been passed by the State Government and accordingly all water courses and all water is such water courses in the State should be the property of Government.

Table : 6.1.1

Primary water quality criteria

Sl.No	Designated best use	Class	Criteria *			
			PH	Dissolved Oxygen	B.O.D	Coliform
				Minimum	Maximum	Maximum
1	Drinking water after disinfection	A	6.5-8.5	6	2	50
2	Bathing	B	6.5-8.5	5	3	500
3	Drinking water cleaning and disinfection	C	6-9	4	3	5000
4	Propagation of fisheries	D	6.5-8.5	4	-	-
5	Agriculture (irrigation), industrial cooling, controlled waste disposal	E	6-8.5	-	-	-

* - *Rate of dissolved oxygen, BOD – Bio –chemical Oxygen Demand in per litre water in terms of milligram and Coliform bacteria in 100 milliliters water in terms of numbers.*

Source: State Pollution Control Board.

Table: 6.1.2

Minimum and maximum observed values of water quality parameters at PWD sites and rivers.

Sl.No	Name of river	Name of site	Quality parameters				
			pH	Dissolved Oxygen	B.O.D	Coliform bacteria	Class
1.	Karamana	Peppara	6.9	7.8	1.4	2300	A
		Aruvikara	6.9	6.8	3.8	127.5	A
		Mankattukadavu	6.55	8.0	2.1	430	A
		Munnattumukku	6.89	7.01	1.25	1250	D
2.	Kallada	Urukunnu	7.1	8.9	1.4	2500	A
		Punalur	7.1	8.2	1.2	2200	A
		Pathanapuram	7.1	8.6	1.1	7200	A
		Enathu	7.1	8.3	1.2	7200	A
3	Achankovil	Aruvapulam	7.3	8.4	1.6	4600	A
		Konni	7.3	7.7	1.4	9600	A
		Kumbaza	7.3	7.5	1.4	7800	A
		Panthalam	7.9	7.7	1.1	12600	A
		Pallipadu	7.4	7.5	1.3	4600	D
4	Pamba	Pamba	6.9	2.0	8.9	60000	A
		Athikayam	6.8	8.3	7.0	15000	A
		Vaddasserikara	7.0	7.6	2.0	35000	A
		Ranni	7.0	7.7	2.0	7000	A
		Chengannur	6.8	7.0	2.0	6200	A
		Pulikeezu	6.6	1.5	6.8	30000	C
5	Manimala	Piruvanthanam	6.8	7.6	2.0	2300	A
		Erumeli	6.8	7.7	2.0	2300	A
		Manimala	7.0	7.5	2.0	2300	A
		Mallapally	6.8	6.7	2.0	2200	A
6	Meenachilaru	Theekoy	7.1	7.1	1.3	2800	A
		Bharananganam	7.2	7.3	1.2	4900	A
		Kadapatoor	7.1	7.1	1.2	1500	A
		Punathara	7.1	7.1	1.2	1650	C
		Thazathangadi	7.0	7.0	1.2	2750	C
7	Moovattupuzha	Malamkara	7.0	7.1	1.3	8700	A
		Moovattupuzha	7.1	7.0	1.1	3800	A
		Ramamangalam	7.0	7.1	1.4	3500	C
		Piravam	7.1	7.2	1.5	11350	C
8	Periyar	Neriyamangalam	7.4	8.0	0.5	5200	A
		Bhoothankettu	7.6	8.5	0.3	5400	A
		Kodanadu	7.5	8.0	0.2	8500	A
		Chowara	7.3	7.8	0.25	4500	C
		Elur	6.4	5.6	0.3	1200	E

Contd...

Table : 6.1.2 (continuation)

Minimum and maximum observed values of water quality parameters at PWD sites and rivers.

Sl.No	Name of river	Name of site	Quality parameters				
			pH	Dissolved Oxygen	B.O.D	Coliform bacteria	Class
9	Chalakudi	Athirampilly	7.6	8.0	0.8	5900	A
		Peringal	7.5	7.8	0.9	6100	A
		Palpuzha	7.6	7.9	0.6	8200	A
		Pulikalkadavu	7.27	7.9	0.9	6000	A
		Chalakudy	7.8	8.0	0.8	8000	A
10.	Valapattanam	Irikur	8.3	8.2	1.8	2400	A
		Korali	7.5	8.8	1.8	2200	D
		Valapattanam	8.0	7.7	2.3	2900	D
11.	Bahrathapuzha	Parali	7.8	8.1	2.8	4000	A
		Lakidi	7.5	7.8	3.2	2300	A
		Shornur	7.87	7.8	2.1	4200	A
		Pattambi	8.05	8.4	2.4	5700	A
		Kuttipuram	7.95	8.0	2.2	2000	A
12	Chaliyar	Nilambur	7.08	7.6	0.9	2100	A
		Arikode	7.2	6.6	1.0	2200	A
		Kulimadu	7.6	6.8	0.9	2200	A
		Chungapally	7.3	6.1	1.1	2000	C
		Lachikadavu	7.1	6.7	1.0	2200	E
		Farook	7.5	6.0	1.1	2400	E

Source : Pollution Control Board, Kerala.

GROUND WATER

In Kerala ground water resources are largely concentrated in the sedimentary aquifers of the coastal regions. The groundwater resources are tapped mainly for drinking and irrigation purposes.

Table 6.1.3

Ground water resources in Kerala. (mcm)

01	Total replishable ground water resources	7048.66
02	Net ground water potential	6430.06
03	Gross ground water draft	2696.94
04	Net availability for future irrigation	3126.13

TABLE – 6.1.4

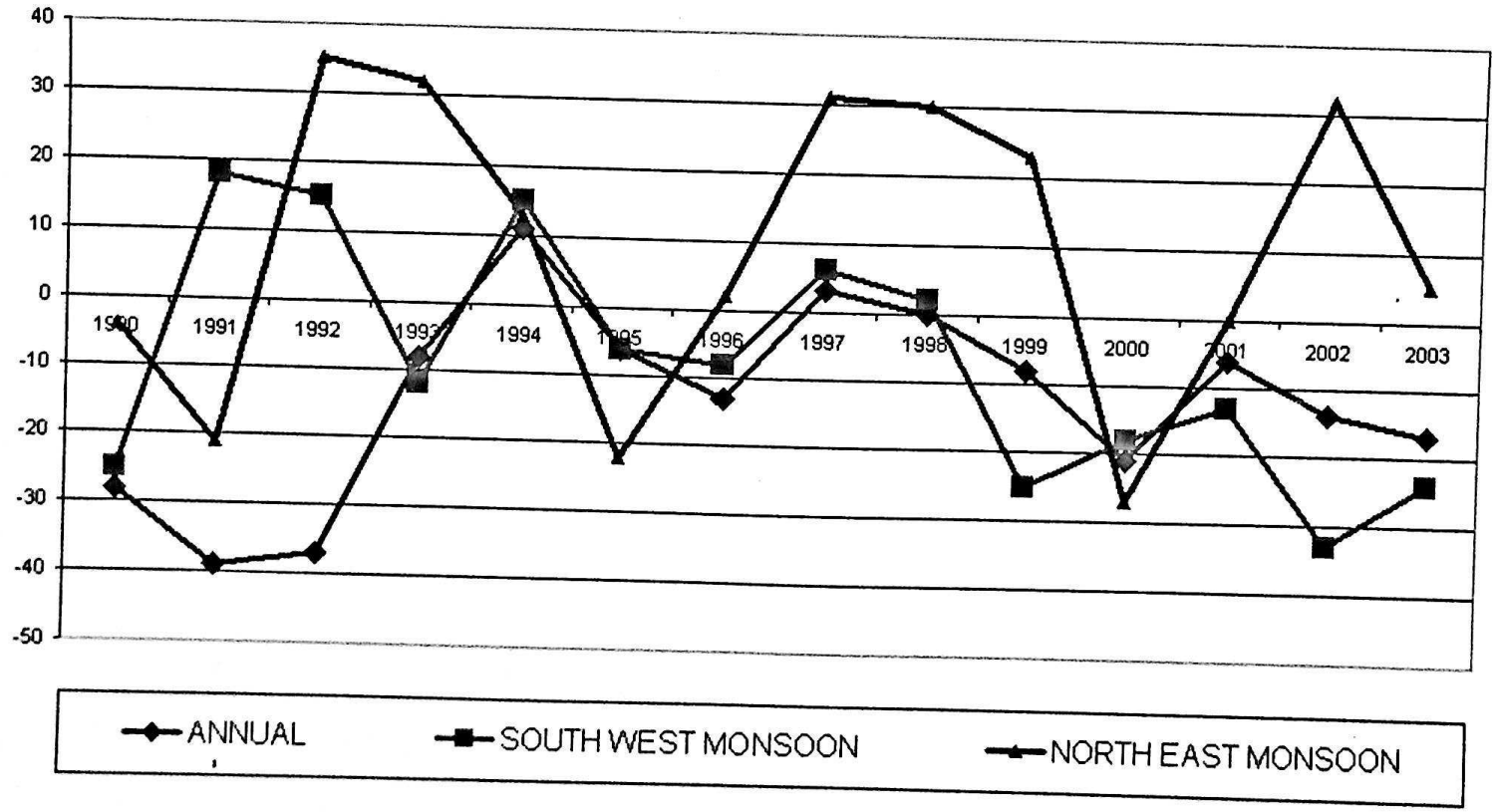
GROUND WATER RESOURCES OF KERALA AS ON 31.03.1999

(Figures in MCM)

Sl. No.	District	Total Annual Ground Water Recharge	Natural Discharge during Non-Monsoon Season	Net Annual Ground Water Availability	Existing Gross Ground water draft for Irrigation	Existing Gross Ground Water for Domestic and Industrial uses	Existing Gross Ground Water draft for all uses	Allocation for domestic and industrial water supply for next 25 years	Net Ground Water Availability for future Irrigation Development	Existing stage of Ground Water Development (%)
1	2	3	4	5	6	7	8	9	10	11
1.	Thiruvananthapuram	308.51	30.48	278.03	84.20	94.59	178.79	111.58	82.25	64.31
2.	Kollam	495.61	47.36	448.25	114.03	88.75	202.78	111.94	222.28	45.24
3.	Pathanamthitta	347.00	30.44	316.56	49.66	42.03	91.69	58.05	208.85	28.96
4.	Alappuzha	466.08	46.62	419.46	61.06	67.46	128.52	92.37	266.03	30.64
5.	Kottayam	521.06	50.20	470.86	62.89	67.43	130.32	92.52	315.45	27.68
6.	Idukki	269.04	22.72	246.32	41.77	41.64	83.41	57.08	147.47	33.86
7.	Ernakulam	618.43	50.59	567.84	197.59	86.44	284.03	112.21	258.04	50.02
8.	Thrissur	774.99	72.19	702.80	228.27	101.36	329.63	130.24	344.29	46.90
9.	Palakkad	823.92	73.55	750.37	140.47	159.85	300.32	191.81	418.09	40.02
1	Malappuram	557.29	49.66	507.63	165.45	115.23	280.68	156.50	185.68	55.29
1	Kozhikode	366.41	21.60	344.81	104.86	86.80	191.66	112.63	127.32	55.58
1	Wayanad	324.39	32.44	291.95	34.40	28.67	63.07	40.40	217.15	21.60
1	Kannur	591.89	51.27	540.62	107.29	76.52	183.81	101.38	331.95	34.00
1	Kasaragod	376.18	32.64	343.54	204.08	40.59	244.67	43.08	96.38	71.22
TOTAL		**6840.80**	**611.76**	**6229.04**	**1596.02**	**1097.36**	**2693.38**	**1411.79**	**3221.23**	**43.24**

Source : Economic Review, 2003.

CHART : DISTRIBUTION OF RAINFALL



Rain Water Harvesting

Kerala is blessed with two predominant raining seasons caused by SouthWest and NorthEast Monsoon. On an average the state receives 3000 mm of rains, of which 60% is obtained during SouthWest Monsoon. 25% during the NorthEast Monsoon and 15% during summer months. State looses about 40% of the rain water through run off. Hence rainwater harvesting assumes importance in our State.

TABLE – 6.1.5

PERFORMANCE OF RAINFALL IN A YEAR

(Percentage Departure of Rainfall From Normal 1990 To 2003)

Unit: mm

YEARS	ANNUAL	SOUTH WEST MONSOON	NORTH EAST MONSOON
1990	-28	-25	-4
1991	-39	18	-21
1992	-37	15	35
1993	-8	-12	32
1994	11	15	13
1995	-6	-6	-22
1996	-13	-8	2
1997	3	6	31
1998	0	2	30
1999	-8	-25	23
2000	-21	-18	-27
2001	-6	-13	0
2002	-14	-33	32
2003*	-17	-24	4.9

Source: Directorate of Economics and Statistics, Kerala

TABLE – 6.1.6

STATEMENT SHOWING THE DISTRICT-WISE RAINFALL DURING THE YEARS 1998 TO 2003

Unit: mm

SL. NO	DISTRICT	1998		1999		2000		2001		2002		2003	
		Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal
1.	Thiruvananthapuram	2081.2	2203.8	1927	1955	1501	1955	2234.6	2203.8	1502.6	1954.5	1393.9	1685.5
2.	Kollam	2526.0	2555.1	2886	2729	2353	2729	2505.6	2555.1	2273.3	2497.9	1872.5	2182.5
3.	Pathanamthitta	3097.0	2965.4	3380	3087	2638	3087	2827.0	2965.4	2563.4	2763.1	2181.9	2536.6
4.	Alappuzha	3149.9	3133.8	3104	3025	2685	3025	2958.8	3133.8	2531.8	2837.0	2460.8	2576.2
5.	Kottayam	3398.9	3130.3	2957	3047	2412	3047	3175.8	3130.3	2780.2	3000.8	2601.6	2794.3
6.	Idukki	4249.2	3379.4	3833	3946	3622	3946	3940.9	3379.4	3156.4	2963.3	3068.9	2807.9
7.	Ernakulam	3318.4	3274.3	3053	3250	2658	3250	3747.5	3274.3	2893.3	2987.6	2496.0	2877.9
8.	Thrissur	3337.5	3262.0	2767	3097	2074	3097	2773.6	3262.0	2522.8	3041.0	2200.3	2863.2
9.	Palakkad	2416.7	2389.8	2122	2363	1831	2363	2033.8	2389.8	1750.3	2228.0	1685.5	2091.2
10.	Malappuram	3031.9	2906.1	2852	2560	2191	3185	2778.3	3667.9	2710.8	3425.2	2226.2	3264.0
11.	Kozhikode	3382.1	3667.9	2819	3185	2529	2560	2690.6	2906.1	2281.3	2830.9	2131.3	2719.0
12.	Wayanad	2433.2	3590.8	2231	3622	2344	3622	2075.4	3590.8	1914.2	3408.8	1854.4	3280.8
13.	Kannur	3482.8	3465.0	3037	3375	2918	3375	3048.0	3495.0	3108.5	3321.8	2832.4	3220.4
14	Kasaragod	3769.7	3581.3	3235	3480	3152	3480	3923.8	3581.3	3223.0	3606.9	3025.9	3494.1
State Average		**3119.6**	**3107.5**	**2872**	**3052**	**2493**	**3052**	**2908.1**	**3107.5**	**2515.1**	**2919.1**	**2288.0**	**2742.4**

TABLE – 6.1.7

STORAGE IN THE RESERVOIRS (IRRIGATION) – BASIN WISE

Sl. No.	Reservoirs	River Basin	Live storage capacity (MCM)	Full Reservoir level (Mtrs)
A. Completed				
1.	Kuttiyadi	Kuttiyadi	120.5	43.54
2.	Peechi	Karuvannoor	113.00	79.25
3.	Vazhani	Keecheri-puzhakkal	18.12	62.48
4.	Walayar	Bharathapuzha	18.4	203.00
5.	Gayathri	Bharathapuzha	25.00	310.44
6.	Mangalam	Bharathapuzha	25.34	77.88
7.	Periyar Valley	Periyar	...	34.95
8.	Malampuzha	Bharathapuzha	226.00	115.06
9.	Pothundi	Bharathapuzha	50.91	108.20
10.	Neyyar	Neyyar basin	106.18	84.73
11.	Chimmoni	Karuvannoor	176.36	NA
12.	Kallada	Pallickkal-Kallada	504.92	116.20
13.	Malankara	Muvattupuzha	27.00	...
14.	Pazhassi	Valapattanam	...	26.52
15.	Pamba	Pamba Basin	6.5	...
16.	Siruvani	Bhavani	184.00	...
17.	Kanhirapuzha	Bharathapuzha	70.83	97.50
B. Under Construction				
18.	Karapuzha	Kabani	72.00	...

Source: Economic Review-2003

TABLE-6.1.8

OVERVIEW OF ENVIRONMENTAL LEGISLATION AND EXECUTING AUTHORITIES

Legislation	Objectives	Executing Authority
Water Act(1974) and Rules	Prevention and Control of water pollution	Kerala State Pollution Control Board
Water Cess Act(1977) and Rules	Cess on water consumption	Kerala State Pollution Control Board
Air Act (1981) and Rules	Prevention ,Control and Abatement of air pollution	Kerala State Pollution Control Board
Environment Act(1986) and Rules	Protection and Improvement of the environment : Environmental Statement Environmental Standars Environmental Clearance	Govt. of India & Kerala State Pollution Control Board
Hazardous Wate Rules	Control of Hazardous waste	Kerala State Pollution Control Board
Hazardous chemical Rules	Control of Hazardous chemical	Kerala State Pollution Control Board /F&B Dept.
Hazardous Micro Organism & Cells Rule	Control of Hazardous Micro orgganism & Cells	Central Govt.
Public Liability Insurance Act (1991) and Rules	Assistance to Entities affected by accidents concerning hazardous substances handling	District Collector
Forest Act & Rules	Conservation of Forest & Connected Matters	Govt. of India & State Forest Department
Biomedical Waste (1998) Rule	Control of Biomedical Waste	Kerala State Pollution Control Board
Recycle of Plastic (1999) Rules	Control of Manufature and use of Plastic	Kerala State Pollution Control Board / District Collector
Motor Vehicle Act and Rules	Control of motor vehicle pollution	Motor Vehicle Department

Source: Economic Review-2003.

TABLE : 6.1.9
DETAILS OF RIVERS IN KERALA

Sl. No.	Name of River	Length		Catchment Area							
				Kerala		Karnataka		Tamil Nadu		Total	
		Km	Miles	Sq. km	Sq. miles	Sq. km	Sq. miles	Sq. km	Sq. miles	Sq. km	Sq. miles
1	2	3	4	5	6	7	8	9	10	11	12
I. West Flowing Rivers											
1.	Manjeswaram	16	10	90	35	--	--	--	--	90	35
2.	Uppala	50	31	76	29	174	67	--	--	250	96
3.	Shiriya	67	42	290	112	297	115	--	--	587	227
4.	Mogral	34	21	132	51	132	51	--	--	132	51
5.	Chandragiri	105	65	570	220	836	322	--	--	1406	542
6.	Chittari	25	16	145	56	--	--	--	--	145	56
7.	Nileswaram	46	29	190	73	--	--	--	--	190	73
8.	Kariangode	64	40	429	166	132	51	--	--	561	217
9.	Kavvayi	31	19	143	55	--	--	--	--	143	55
10.	Peruvamba	51	32	300	116	--	--	--	--	300	116
11.	Ramapuram	19	12	52	20	--	--	--	--	52	20
12.	Kuppam	82	51	469	181	70	27	--	--	539	208
13.	Valapattanam	110	68	1321	510	456	211	--	--	1777	721
14.	Anjarakandy	48	30	412	159	--	--	--	--	412	159
15.	Tellichery	28	17	132	51	--	--	--	--	132	51
16.	Mahe	54	34	394	152	--	--	--	--	394	152
17.	Kuttiadi	74	46	583	225	--	--	--	--	583	225
18.	Korapuzha	40	25	624	241	--	--	--	--	624	241
19.	Kallayi	22	14	96	37	--	--	--	--	96	37
20.	Chaliyar	169	105	2535	679	--	--	388	150	2923	1129
21.	Kadalundy	130	81	1122	433	--	--	--	--	1122	433

1	2	3	4	5	6	7	8	9	10	11	12
22.	Tirur	48	30	117	45	--	--	--	--	117	45
23.	Bharathapuzha	209	130	4400	1699	--	--	1786	690	6186	2389
24.	Keecheri	51	32	401	155	--	--	--	--	401	155
25.	Puzhakkal	29	18	234	90	--	--	--	--	234	90
26.	Karivannur	48	30	1054	407	--	--	--	--	1054	407
27.	Chalakudy	130	81	1404	542	--	--	300	116	1704	658
28.	Periyar	244	152	5284	2040	--	--	114	44	5398	2084
29.	Muvattupuzha	121	85	1554	600	--	--	--	--	1554	600
30.	Meenachal	78	48	1272	491	--	--	--	--	1272	491
31.	Manimala	90	56	847	127	--	--	--	--	847	327
32.	Pamba	176	109	2235	863	--	--	--	--	2235	863
33.	Achencoil	128	80	1484	573	--	--	--	--	1484	573
34.	Pallickal	42	26	220	85	--	--	--	--	220	85
35.	Kallada	121	75	1699	656	--	--	--	--	1699	656
36.	Ithikkara	56	35	642	248	--	--	--	--	642	248
37.	Ayroor	17	11	66	25	--	--	--	--	66	25
38.	Vamanapuram	88	55	687	266	--	--	--	--	687	266
39.	Mamom	27	17	114	44	--	--	--	--	114	44
40.	Karamana	68	42	702	271	--	--	--	--	702	271
41.	Neyyar	56	35	497	192	--	--	--	--	497	192
Total		**3092**	**1935**	**35018**	**13520**	**1965**	**793**	**2588**	**1000**	**39571**	**15313**
II. East Flowing Rivers											
1	Kabani									1920	741
2	Bhavani									562	217
3	Pambar									384	118
Total										**2866**	**1106**

TABLE – 6.1.10

INDUSTRIES AND SEWAGE DISCHARGES IN PERIYAR RIVER BASIN

Sl No	Industry/Location	Type/Products	Waste Water Generated (m^3/d)
1.	Travencore Rayons Ltd., Perumbavur	Cellulose yarn & film	46,000
2.	Periyar Chemicals Ltd., Edayar	Formic acid. Sodium sulphate	330
3.	Binani Zinc Ltd., Edayar	Zinc, Cadmium, Sulphuric acid	550
4.	FACT Ltd., Eloor	Nitrogen & Phosphorus Fertilisers, Oleum & Ammonium Sulphate.	25,400
5.	FACT, Petrochemical	Caprolactam. Nitric acid, Ammonium sulphate, Soda ash	5,040
6.	Travancore Cochin Chemicals	Hydrochloric acid	6,680
7.	Indians Aluminium Company, Eloor	Aluminium products.	2,700
8.	Trava Chemical & Mfg. Kalamassery	Copper products	720
9.	United Catalysts Ltd., Edayar	Chemicals, Catalyusts	537
10.	Hindustan Insecticides, Eloor	DDT, BHC, Endosulfan, Difocol	1,000
11.	Indian Rare Earths, Eloor	Rare earths, Tri sodium phosphate	3,000

Source : Economic Review-2003.

MARINE WATER

Oceans cover about 71% of the earth's surface. The influence of ocean in our life and our physical environment is huge. It is in the oceans that the first forms of life originated. As land, ocean is also enriched with various minerals, plants and animals. It is indispensable for the survival of humanity.

Table : 6.2.1

LENGTH OF COASTAL LINE AND COASTAL POPULATION (MARINE) OF KERALA (2002-03).

Sl No	Districts	Coastal Length (Kms)	Population (Marine)			
			Male	Female	Children	Total
1.	Thiruvananthapuram	78	52601	50929	72324	175854
2.	Kollam	37	31826	29138	38007	98971
3.	Pathanamthitta	--	--	--	--	--
4.	Alappuzha	82	36576	35376	45514	117466
5.	Kottayam	--	--	--	--	--
6.	Idukki	--	--	--	--	--
7.	Ernakulam	46	24847	24054	27567	76468
8.	Thrissur	54	22650	22929	27998	73577
9.	Palakkad	--	--	--	--	--
10.	Malappuram	70	24880	25452	34053	84385
11.	Kozhikode	71	32717	31533	39890	104140
12.	Wayanad	--	--	--	--	--
13.	Kannur	82	18139	17225	23458	58822
14.	Kasaragod	70	14870	14326	16940	46136
STATE		590	259106	250962	325751	835819

TABLE – 6.2.2

POLLUTANTS AND THEIR IMPACTS ON THE MARINE ENVIRONMENT

SL NO	SOURCES	IMPACTS
1.	Municipal and domestic waste	Reduce dissolved oxygen (DO); increase hydrogen sulphide levels; incidence of faecal coliform & faecal streptococci; high biological oxygen demand (BOD)
2.	Industrial waste	Affect DO, temperature,turbidity, pH, ammonia values; increases BOD, COD, suspended solids
3.	Toxic metals	Cause change in chemical and biochemical processes, increase in turbidity, lethal and sublethal effects on marine life
4.	Oil pollution	Causes smothering, clogging and toxicity
5.	Fertilizers	Affect nutrient levels and may cause eutrophication
6.	Dredging & Reclamation	Affect habitats of marine organisms; lethal and sublethal effects; affects flushing capacity of the waterbody
7.	Siltation	Increases in nutrient levels and can cause excessive algal bloom; may also cause damage to coral reefs and coastal nurseries
8.	Discharge of coolant waters	Raises the temperature of the water can cause the growth of the blue-green algae
9.	Toxic chemicals	Cause lethal and sublethal effects on marine organisms
10.	Offshore mining	Increases particulate loading which can lead to loss of light and reduced primary productivity; smothering and clogging of benthic communities
11.	Radionuclides	Bioaccumulation in fish and other benthic communities

Source: The State of Environment, 1995

TABLE – 6.2.3

POTENTIAL HOTSPOTS ALONG THE KERALA COAST

STATE	COASTAL/ TOWNS
Kerala	Kochin, Thiruvananthapuram

Source: The State of Environment, 1995

TABLE – 6.2.4

CRITERIA FOR CLASSIFICATION OF INLAND SURFACE WATER

Sl. No	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.
1	Dissolved oxygen (mg/litre)	Minimum	6	5	4	4	--
2	Biological oxygen demand (mg/litre)	Minimum	2	3	3	--	--
3	Total coliform bacteria (most probable number per 100 millilitres)	Maximum	50	500	5000	--	--
4	Total dissolved solids (mg/litre)	Maximum	500	--	1500	--	2100
5	Chloride as chlorine (mg/litre)		250	--	600	--	500
6	Colour (hazen)	Maximum	10	300	300	--	--
7	Sodium absorption ratio	Maximum	--	--	--	--	26
8	Boron	Maximum	--	--	--	--	2
9	Sulphates (mg/litre)	Maximum	400	--	400	--	1000
10	Nitrates (mg/litre)	Maximum	20	--	50	--	--
11	Free ammonia as nitrogen (mg/litre)	Maximum	--	--	--	12	--
12	Conductivity at $25^{0}C(\mu s/cm)$	Maximum	--	--	--	1	2.25
13	PH	Maximum	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.0 – 8.0
14	Arsenic (mg/litre)	Maximum	0.05	0.2	0.2	--	--
15	Iron (mg/litre)	Maximum	0.3	--	50	--	--
16	Fluorides (mg/litre)	Maximum	1.5	1.5	1	--	--
17	Lead(mg/litre)	Maximum	0.1	--	0.1	--	--
18	Copper (mg/litre)	Maximum	1.5	--	1.5	--	--
19	Zinc (mg/litre)	Maximum	15	--	15	--	--

Source :Compendium of environment Statistics, 2001 Government of India.

CHAPTER – 7

HUMAN SETTLEMENTS

Man started a settled life when he learned to cultivate crops. This put an end to his endless journey in search of food. He made shelter near his farm. Thus formed the primitive form of settlements. Main factors for settlements are climate, soil, availability of water, inundation, defense etc.
The roads, rivers, water bodies etc., have influenced much the shape of the settlements developed in each region.

Population and Poverty :

POPULATION

As per the census of India, 2001, the annual exponential growth of Kerala's population was the lowest in India at 0.94 percent during the 1990s as against 1.93 percent all India (during the 1980s, the respective rates of growth were 1.34 percent and 3.14 percent). Kerala has a unique position in regard to sex ratio. In all the census, females out numbered males in Kerala.

TABLE – 7.1.1

INFANT MORTALITY RATE IN KERALA

(per thousand Live Births)

YEAR	RURAL	URBAN	COMBINED
1995	16	13	15
1996	13	16	14
1997	11	15	12
1998	15	17	16
1999	14	14	16
2000	14	14	14
2001	12	9	11
2002	11	8	10

Source : . Statistical Planning 2001 & SRS

TABLE – 7.1.2

DISTRICT-WISE POPULATION TOTALS IN KERALA

(In Numbers)

Sl.No	Districts	1971		1981		1991		2001	
		Male	Female	Male	Female	Male	Female	Male	Female
1.	Thiruvananthapuram	808837	818203	1279150	1316962	1447594	1499056	1571424	1663283
2.	Kollam	1110172	1112746	1388678	1424972	1182810	1224756	1248616	1335502
3.	Pathanamthitta					576176	612156	588035	643542
4.	Alappuzha	870005	896021	1146407	1203738	975885	1025332	1012572	1092777
5.	Kottayam	947139	924851	848462	848980	912860	915411	964433	988468
6.	Idukki			494999	476637	545872	532194	566405	562200
7.	Ernakulam	865868	860420	1269174	1277868	1408649	1408587	1535881	1562497
8.	Thrissur	901905	977047	1161675	1277868	1312683	1424628	1422047	1553393
9.	Palakkad	713640	757623	994196	1050203	1155822	1226413	1265794	1351278
10.	Malappuram	848028	883482	1170778	1231923	1508280	1588050	1759479	1870101
11.	Kozhikode	776209	768470	1111409	1133856	1292765	1327176	1398674	1479824
12.	Wayanad			284261	269765	341958	330170	393397	393230
13.	Kannur	1010547	1029713	1378578	1424889	1098838	1152889	1154144	1258221
14.	Kasaragod					528803	542705	587763	615579
TOTAL		**8852350**	**9028576**	**12527767**	**12925913**	**14288995**	**14809523**	**15468664**	**16367955**

Source : Census of India. 1971 – 2001. **TABLE – 7.1.3**

EXPECTATION OF LIFE AT BIRTH IN KERALA-RURAL

(In years)

YEAR	MALE	FEMALE	COMBINED
1979-81	64.7	69.0	66.8
1981-83	66.0	71.8	68.8
1983-85	65.7	72.5	68.9
1985-87	67.1	73.1	70.1
1987-89	67.6	73.9	70.6
1988-90	67.9	74.7	71.1
1989-91	68.1	74.7	71.3
1990-92	67.9	74.8	71.2
1991-93	68.3	75.2	71.6
1992-94	63.4	75.2	67.5
1993-95	70.2	76.6	73.3
1994-96	70.4	76.8	73.5
1995-97	70.2	77.5	73.6
1996-98	69.1	76.1	72.7
1997-99	69.0	76.4	72.5
1998-00	69.3	75.8	72.4

TABLE – 7.1.4

DISTRICT-WISE PERCENTAGE OF POPULATION BELOW POVERTY LINE-FAMILIES IN KERALA - RURAL

SL NO	DISTRICTS	2003
1.	Thiruvananthapuram	39.13
2.	Kollam	39.32
3.	Pathanamthitta	33.06
4.	Alappuzha	45.95
5.	Kottayam	18.10
6.	Idukki	15.29
7.	Ernakulam	26.56
8.	Thrissur	33.54
9.	Palakkad	52.13
10.	Malappuram	41.18
11.	Kozhikode	34.84
12.	Wayanad	49.87
13.	Kannur	38.85
14.	Kasaragod	44.46
State		**36.58**

TABLE – 7.1.5
PERCENTAGE OF POPULATION BELOW POVERTY LINE (RURAL, URBAN & COMBINED) IN KERALA

YEAR	RURAL	URBAN	COMBINED
1973-74	59.19	62.74	59.79
1977-78	51.48	55.62	52.22
1983	39.03	45.68	40.42
1987-88	29.10	40.33	31.79
1993-94	25.76	24.55	25.43
1999-2000	9.38	20.27	12.72

Source : Compendium of Environment Statistics-2001. Govt. of India.

Table – 7.1.6

BLOCK-WISE NUMBER OF FAMILIES BELOW POVERTY LINE ACCORDING TO SOCIAL GROUPS

SL NO	BLOCK	NUMBER OF *BPL* FAMILIES
1	**Thiruvananthapuram**	
1	Parassala	20510
2	Perumkadavilla	23832
3	Athiyannoor	17323
4	Nemom	16089
5	Trivandrum rural	7427
6	Kazhakuttom	13196
7	Vellanad	19083
8	Nedumangad	12714
9	Vamanapuram	18780
10	Kilimannoor	15826
11	Chirayinkeezhu	14002
12	Varkala	9528
Sub Total		**188310**
2.	**Kollam**	
13	Ochira	7646
14	Karunagapally	11418
15	Sasthamkotta	10525
16	Vettikavala	16059
17	Pathanapuram	12568
18	Anchal	19414
19	Kottarakkara	12704
20	Chittumala	8003
21	Chavara	10065
22	Anchalumoodu	11253
23	Mukathala	17597
24	Ettikara	15097
25	Chadayamangalam	23268
	Sub Total	**175617**

Cont//

TABLE – 7.1.6 Contd..

SL NO	BLOCK	NUMBER OF *BPL* FAMILIES
3.	**Alappuzha**	
26	Thikattusseri	11468
27	Panakakadu	20514
28	Kanzhikuzhi	22040
29	Ariyadu	10776
30	Ambalappuzha	13864
31	Champakulam	11021
32	Valiyanadu	8453
33	Chengannoor	14411
34	Harippadu	8876
35	Mavelikkara	11998
36	Bharanikavu	8380
37	Mudhukulam	14350
	Sub Total	**156151**
4.	**Pathanamthitta**	
38	Mallappally	7540
39	Pulikozhu	5664
40	Kozhiparam	7235
41	Elanthur	7073
42	Ranni	12519
43	Konni	8995
44	Pandalam	5074
45	Parakodeu	18368
46	Kulanada	2388
	Sub Total	**74856**
5.	**Kottayam**	
47	Vikkom	2969
48	Kaduthurithi	83
49	Ushavoor	8402
50	Laalam	5556
51	Erattupetta	6938
52	Pambadi	10660
53	Pallam	10603
54	Madapally	13049
55	Vazhoor	922
	Sub Total	**59182**

Cont//

TABLE – 7.1.6 Contd..

SL NO	BLOCK	NUMBER OF *BPL* FAMILIES
6.	**Idukki**	
56	Adimally	6368
57	Devikulam	2758
58	Nadumkandom	3339
59	Elamdesom	5578
60	Idukki	5241
61	Kattappana	6349
62	Thodupuzha	2199
63	Azhutha	2603
	Sub Total	**34435**
7	**Ernakulam**	
64	Paravoor	8505
65	Alangadu	5183
66	Angamali	11728
67	Kuvapadi	2697
68	Vazhkulam	1854
69	Edappally	3524
70	Vippin	9993
71	Palluruthi	5071
72	Vatiila	3354
73	Mulamthurithi	6714
74	Vadavukode	8510
75	Kothamangalam	13281
76	Pambakuda	11249
77	Parakkadavu	7246
78	Moovattupuzha	612
	Sub Total	**99521**
8	**Thrissur**	
79	Chavakkadu	9109
80	Chovannur	9085
81	Vadakkancherry	17822
82	Pazhayannoor	18432
83	Ollukara	10304
84	Puzhakkal	8169

Cont..

TABLE – 7.1.6 Contd..

SL NO	BLOCK	NUMBER OF *BPL* FAMILIES
85	Mallasseri	6070
86	Thalikulam	7473
87	Anthikkadu	5968
88	Charppu	7156
89	Kodakara	14007
90	Iringalakkuda	6485
91	Vallangallur	7134
92	Mathilagam	8523
93	Kodungallur	5251
94	Mala	7758
95	Chalakkudi	10215
	Sub Total	**158961**
9	**Palakkad**	
96	Ottappalam	11535
97	Sreekrishnapuram	13348
98	Mannarkadu	27220
99	Palakkad	18272
100	Kzhalmandam	18460
101	Chottur	20052
102	Kollamkodu	11012
103	Nenmara	13943
104	Alatoor	27018
105	Malampuzha	13144
106	Thrithala	13379
107	Pattambi	17222
	Sub Total	**204605**
10	**Malappuram**	
108	Nilambur	24243
109	Kondotti	12977
110	Vandoor	19142
111	Aricode	15108
112	Malappuram	10741
113	Perunthalmanna	13432
114	Mangada	16419

Cont//

TABLE – 7.1.6 Contd..

SL NO	BLOCK	NUMBER OF *BPL* FAMILIES
115	Kuttipuram	8928
116	Vengara	10343
117	Thirurangadi	11918
118	Thanur	10330
119	Thiroor	10910
120	Ponnani	7610
121	Porambaduppu	8274
	Sub Total	**180375**
11.	**Kozhikode**	
122	Vadakara	4399
123	Tunari	6816
124	Kannummal	13899
125	Thonoor	6176
126	Maladi	7666
127	Perambra	14088
128	Balusscry	15593
129	Panthalayini	4220
130	Chaloor	10290
131	Koduvalli	19327
132	Kunnamangalam	15958
133	Kozhikode	13349
	Sub Total	**131781**
12	**Wayanad**	
134	Mananthavadi	22319
135	Sulthan Batheri	25414
136	Kalpetta	17061
	Sub Total	**64794**
13	**Kannur**	
137	Payyannoor	17264
138	Thaliparambu	19349
139	Irikkoor	19447
140	Knoor	4873
141	Adakadu	9180
142	Thalassery	12262

Cont

TABLE – 7.1.6 Contd..

SL NO	BLOCK	NUMBER OF *BPL* FAMILIES
143	Koothuparambu	15793
144	Irutti	12112
145	Paravoor	11787
	Sub Total	122067
14	Kasaragode	
146	Manjeswaram	14320
147	Kasaragode	17552
148	Kanhangad	20230
149	Neeleswaram	20799
	Sub Total	72901
	State Total	1723556

Source: Economic Review-2003

TABLE – 7.1.7
NUMBER OF SUICIDE CASES BY CAUSE IN KERALA FOR THE PERIOD 2001 & 2002

Sl. No	Causes	2001			2002		
		Male	Female	Total	Male	Female	Total
1.	Failure in examinations	34	52	86	39	50	89
2.	Poverty	3	--	3	2	--	2
3.	Love affairs	87	63	150	48	37	85
4.	Insanity	615	339	954	694	319	1013
5.	Family Problems	1216	572	1788	1610	690	2300
6.	Dispute over property	35	15	50	35	7	42
7.	Deadful diseases	1088	441	1529	1080	423	1503
8.	Unemployment	165	27	192	89	10	99
9.	Bankruptcy or sudden change in economic status	1184	267	1451	1000	135	1135
10.	Death of dear person	49	34	83	51	42	93
11.	Fall in social reputation	57	31	88	17	6	23
12.	Dowry dispute	1	25	26	--	22	22
13.	Illegitimate pregnancy	2	13	15	--	6	6
14.	Causes not known	600	240	840	1156	405	1561
15.	Other causes	1651	666	2317	1344	493	1837
Total		**6787**	**2785**	**9572**	**7165**	**2645**	**9810**

Source: Economic Review – 2003

HOUSING SLUM AND BASIC FACILITIES :

As a part of the National Slum Development Programme in Kerala, the state has so far tackled the problem of slum dwellers as given below.

Table : 7.2.1

PHYSICAL ACHIVEMENT OF NATIONAL SLUM DEVELOPMENT PROGRAMME

(As on september 2003)

SlNo.	Name of component	Achievement
1	Construction of houses - in nos	29324
2	Shelter up-gradation - in nos.	29624
3	Construction of latrines – in nos.	25589
4	Construction of wells – in nos.	1064
5	Construction of community bath rooms - in nos.	2400
6	Garbage bins - in nos.	932
7	Construction of roads and pedestrian foot path - in kms	4201
8	Wiring of houses – in nos.	8103
9	Water connection – in nos.	769
10	Street lights – in nos.	786
11	Construction of community hall – in nos.	15
12	Construction of sewerage – in nos.	58
13	Storm water drainage – in kms	130

Source : Kudumbashree

TABLE 7.2.2

URBAN-RURAL BREAK UP OF TOTAL POPULATION, NUMBER OF HOUSEHOLDS, LIVING QUARTERS AND AVERAGE SIZE OF HOUSE HOLDS AND PERSONS LIVING QUARTERS

Year	Total Population	Total Urban Population	Total Rural Popula-Tion	No. of House Holds (Lakhs)	Size of House Holds
1971	21347375	3466449	17880926	35.43	6.03
1981	25453680	4771275	20682405	44.23	5.75
1991	29098518	7680294	21418224	55.13	5.28
2001	31838619	8267135	23571484		

Source: Census reports-1971-2001

TABLE 7.2.3

HOUSING SITUATION OF KERALA

Sl. No.	Item	Numbers in lakhs	
		1991	2001
1	2	3	4
1.	Total houses	80.72	93.56
2.	Residence and Residence Cum other used houses	54.59	65.32
3.	House holds	58.90	65.95
4.	House hold size average (Numbers)	5.3	4.9
5.	(i) Pucca Houses	30.56	36.30
	(ii) Semi Pucca/livable	10.44	23.30
	(iii) Kutcha Houses/ Dilapidated	13.59	5.33
6.	House holds and Drinking water		
	(i). Drinking water within premises	36.12	47.20
	(ii). Drinking water near premises	NA	10.85
	(iii). A way from premises	17.78	7.90
7.	House holds source of Lighting		
	(i). Electricity	26.10	46.33
	(ii). Kerosene	NA	19.19
	(iii). Others	NA	0.43

Source: Economic Review-2003.

Table : 7.2.4

Shortage of Housing in Urban areas (as on 1.03.91)

Name of city	Total households	No of houses	Housing shortage	Congestion factor	Obsetescenses Factor`	Total shortage	Shortage in millions
1	2	3	4	5	6	7	8
Kochi	210582	206525	17419	10062	8674	36155	0.036

Source : Compendium of Environment Statistics, 2001

Table : 7.2.5

Urban housing shortage projection during ninth five year plan 1997-2001

State	1997	1998	1999	2000	2001
Kerala	0.32	0.31	0.30	0.29	0.28

Source: Compendium of Environment Statistics, 2001

Basic Amenities

Latrines: -

Kerala has the highest coverage of individual household latrines in India. The percentage of households with access to sanitation facilities according to different estimates is given in the following table.

Table: 7.2.6

Household sanitary Latrines.
Access to sanitation facilities.

Time line	1991 (1)	1995 (2)	2001 (3)
Rural household with toilet (In percentage)	44	73.4	81.3
Urban households with toilet (in percentage)	73	90	82

Source: 1 – Census of India 1991
2 – NSSO 1995
3 – Census of India 2001

Table: 7.2.7

Identified/Estimated slum population (in lakhs) in Kerala.

1981			1991			2001		
Urban population	Identified slum population	%	Urban population	Identified slum population	%	Urban population	Identified slum population	%
47.713	4.101	8.6	76.803	12.218	15.9	103.474	16.452	15.9

Source: Compendium of Environmental Statistics 2001.

Table: 7.2.8

Identified/Estimated percentage distribution of slum population
According to size/class categories of cities/towns in 1991.

State	Percentage distribution			Total slum population
	Class I	Class II	Others	
Kerala	50.4	2.7	46.9	12.218

Source: Compendium of Environment statistics, 2001

Waste Management

The waste management problem is acute in cities and towns due to the migration of people from villages. Unscientific management of wastes leads to serious environmental problems. It is estimated that only about 50% of the 2500 tonnes of waste generated per day is collected for disposal. Everyday a quantity of about

1200 tonnes of waste is left to decompose on road margins, drains, canals, water bodies and open space. [Economic review]

Wastes are of various types. Solid waste is a mixture of organic and inorganic waste materials produced from domestic or commercial activities, which has lost its value in the eye of the first owner. Solid wastes in urban settlings can be broadly categorized into three: -

- Municipal solid waste (MSW)
- Hospital wastes (HW)
- Industrial solid wastes (ISW)

Table : 7.3.1

SOLID WASTE CONSTITUTION.

Sl.No	Type	Percentage
1	Household waste	28
2	Shops/markets/hotels/slaughter houses	44
3	Brick/Oil/concrete	6
4	Sullage	4
5	Street sweepings	10
6	Others	5

TABLE - 7.3.2

DISPOSAL OF WASTE WATER IN PERCENTAGE

Sl. No	Variables			Kerala
1	Disposal	1	Soak Pit	6
		2	Open Pit	13
		3	On the Street	4
		4	Back yard	48
		5	In Drain connected with Main	2
		6	In Drain ending in open	4
2	Perception about safe method of disposal of waste water	1	Kitchen garden	27
		2	Soak Pit	15
		3	Open Pit	17
		4	Drain	18
		5	Don't Know	6
3	Stagnent water Classes	1	Spreads Disease	35
		2	Causes Inconvenience	3
		3	Smells Bad	13
		4	Breeds Mosquitoes	65

Source : Economic Review-2003

Table : 7.3.3

Composition of solid waste.

Sl.No.	Component	Percentage
1	Biodegradable	68
2	Cioth, timber	20
3	Plastic, rubber, glass, metal	7
4	Brick, etc.	

The carbon : nitrogen ratio of solid wastes in Kerala, 20: 1 – 30:1, is most suitable for composting. Due to low calorific value of solid wastes (1100 kilo-calorie/kilogram) and high moisture content due to the prolonged monsoon season, it is not practicable to adopt thermal process in Kerala.

Table 7.3.4

COLLECTION AND TREATMENT OF WASTE WATER

IN MAJOR CITIES IN KERALA

SL.No	TOWN	STATUS		METHOD
		COLLECTION	TREATMENT	
1.	Thiruvananthapuram	Partial	Partial	Primary & Secondary Treatment
2.	Ernakulam	Partial	Partial	Farming
3.	Kozhikode	Nil	Nil	Nil

Table: 7.3.5

Primary water quality criteria for different water bodies (inland waters) classified according to best-designate use.

		Use Class				
Sl.No	Parameter	A	B	C	D	E
1	Dissolved Oxygen(DO) mg/l, min	6	5	4	4	-
2	BOD (3 days at 27°C) mg/l, max	2	3	3	-	-
3	Total coliform organisms MPN/100ml, max.	50	500	5000	-	-
4	pH	6.5 - 8.5	6.5 - 8.5	6.0 - 9.0	6.5 - 8.5	6.0-8.5
5	Free ammonia (as N) mg/l, max.	-	-	-	1.2	-
6	Electrical conductivity micro-ohms/cm, max	-	-	-	-	2250
7	Sodium absorption ratio, max	-	-	-	-	26
8	Boron, mg/l, max	-	-	-	-	2

Note: -

A - Drinking water source without any conventional treatment but after disinfection.
B – Outdoor bathing –organized.
C – Drinking water source with conventional treatment followed by disinfection.
D – Propagation of wild life and fisheries
E – Irrigation, industrial cooling, controlled waste disposal.

Table :7. 3.6

General standards for discharge of effluents.
The Environment (protection) rules 1986.

Sl.No.	Parameter	Standards			
		Inland surface Water	Public sewers	Land for irrigation	Marine coastal areas
1	2	3			
		(a)	(b)	(c)	(d)
1	Colour and odour	See note 1	-	See note 1	See note 1
2	Suspended solids, mg/l, max	100	600	200	a) For process waste water –100 b) For cooling water effluent-10 per cent above total suspended matter of influent cooling water.
3	Particle size of suspended solids	Shall pass 850 micron IS sieve	-	-	a) Floatable solids, max 3 mm b) Settleable solids max 850 microns.
4	Dissolved solids (inorganic), mg/a, max.	2100	2100	2100	-
5	pH value	5.5-9.0	5.5-9.0	5.5-9.0	5.5-9.0
6	Temperature °				

Note 1

Bio-medical waste.

The Kerala state Population Control Board (PCB) is the prescribed authority to implement Bio-medical waste (Management and handling) rules in the state.

Table : 7.3.7

Hospitals in Kerala.

No of hospitals	**5000**
Bed strength – Government	40000
Bed strength – Private sector	58000
Bi—medical waste cremenated	30 T daily
General waste cremenated	170 T daily.

Table : 7.3.8
Composition of hospital waste.

Infectious waste	10 %
Toxic waste	5%
General waste	85%

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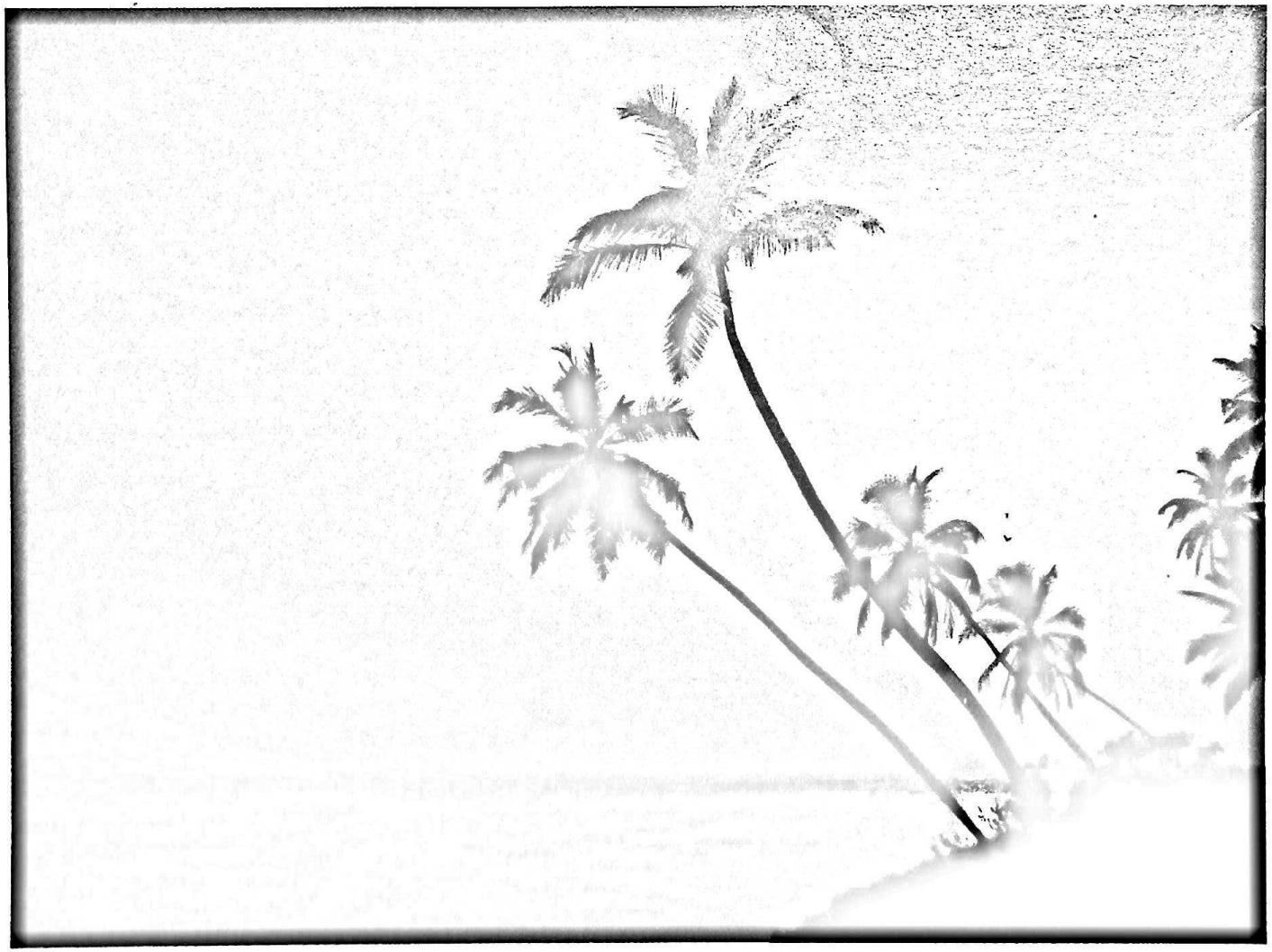

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