

CHAPTER 6

ENVIRONMENT

Introduction

Ever since the 1972 Stockholm conference of the Heads of Nations and subsequently the UN Conference of Environment and Development (UNCED) held in Rio de Janeiro in 1992, followed by the Johannesburg Conference on Sustainable Development in 2002, the concerns of all nations including India, have been increasingly aired to conserve, preserve and protect our natural resources on a sustainable basis in the best interest of the people. In many developing countries the costs of environmental degradation have been estimated at 4 to 8 per cent of GDP annually.

Wet land Conservation

Distribution

6.1 The total wetland area of the country is about 4.1 million hectares. Wetlands are distributed in different geographical regions (Table 6.1). There are 32 natural and 2121 man made wet lands in the State. Changes in the natural landscape through resource extraction, conversion for crop production, urbanisation, altered water balance and hydrological regimes have influenced the state of wetlands in the state. Wetlands have a fragile ecosystems and they require more concerted attention than to rivers and stream basins. Various ecological problems occur in wetlands such as eutrophication, contamination by toxic chemicals, accelerated sedimentation, excessive water diversion, fish resource depletion, encroachment and habitat alteration.

6.2 Conservation of wetlands was initiated in 1987 in India with the objective of assessment of wet land resources, identification of wetlands of national importance, promotion of R&D activities and formulation and implementation of Management Action Plans (MAP) of the identified wetlands. The notified wet lands in the country are shown in the Appendix 6.1

6.3 India is a signatory of the Ramsar Convention, which calls for the conservation of the ecosystems while ensuring benefits to the local communities. The features

of use include assessment of wetland resources, developing wetland policy, inventory, capacity building, conservation of wetland sites and research. The real cause appears to be the complexities of implementation of the 'total protection' approach to wetlands, which is the standard norm for terrestrial protected areas. The National Committee on Wetlands and State Committees have a major role to play to protect wetlands in association with line departments, NGOs and PRIs, with appropriate co-ordination mechanism. A state level steering committee has been constituted. Sasthamcottah, Vembanad and Astamudi are the notified wet lands under Ramsar convention.

6.4 Even though MAPs have been prepared, the implementation is quite weak and the state could not even get the full sanctioned amount from Government of India. Kerala State Council for Science Technology and Environment has taken up projects for Wetland Management in the state of Kerala. Accordingly, a wetland conservation and management programme is being executed for the Sasthamcotta and Ashtamudi wetland system. A management action plan was formulated and implementation of the same was being done by the District Collector, Kollam. However the progress of implementation is very slow. The features of Ashtamudy estuary are shown in BOX.6.1 Ashtamudy estuary is the second largest estuary in Kerala. The water body derives its name from the plannimetric shape with eight branches radiating from the central part.

6.5 State has to prepare action plan for wetlands project implementation. Wetlands are rich in floral and faunal biodiversity and they harbour a large number of endangered and threatened species. Immediate steps should be taken to protect them by changing their legal status to that of a protected category. Peoples's participation is an important component of all the wetlands identified for conservation and management. Participatory methods are to be adopted with the involvement of PRIs, NGOs and local communities in the co-management of wetlands. The need for a proper management of existing wetlands should be a priority of the state.

Table 6.1 :
State /Union Territory wise Distribution of Wet Lands in India

State	Natural		Manmade	
	No	Area (Ha)	No	Area (Ha)
Andhra Pradesh	219	1,00,457	19,020	4,25,892
Arunachal Pradesh	2	20,000	NA	NA
Assam	1,394	86,355	NA	NA
Bihar	62	224,788	33	48,607
Goa	3	12,360	NA	NA
Gujarat	22	394,627	57	129,660
Haryana	14	2,691	4	1,079
Himachal Pradesh	5	702	3	19,165
Jammu & Kashmir	18	7,227	NA	21,880
Karnataka	10	3,320	22,758	5,39,195
Kerala	32	24,329	2,121	2,10,579
Madhya Pradesh	8	324	53	1,87,818
Maharashtra	49	21,675	1,004	2,79,025
Manipur	5	26,600	NA	NA
Meghalaya	2	NA	NA	NA
Nagaland	2	210	NA	NA
Orissa	20	1,37,022	36	5,391
Punjab	33	17,085	6	5,391
Rajasthan	9	14,027	85	1,00,217
Sikkim	42	1,101	2	3.5
Tamil Nadu	31	58,868	20,030	2,01,132
Tripura	3	575	1	4,833
Uttar Pradesh	125	12,832	28	2,12,470
West Bengal	54	2,91,963	9	52,564
Total	2,164	14,49,338	65,250	25,87,965
Union Territories				
Chandigarh	NA	NA	1	170
Pondicherry	3	1,533	2	1,131
Total	2,167	14,50,861	65,253	25,89,266

Note : i. These figures may differ from the figures generated by the GIS/RS study

ii. This table includes wetlands that are less than 100 hectares in area

Source: Jyothi Parikh and H. Datye, 2003

Box -6.1

Features of Ashtamudi Estuary

- Dissolved oxygen is low in the Ashtamudi. It is 3.2 mg/l in the non-monsoon compared to the values of about 5 mg/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 best sediment organic content.
- Fleshing of the Kayal is slow and so discharges to the water body need to be minimised.
- Polluting hydrocarbon content is highest in the fishing harbour area and along the national waterway.

Source: CESS

Mangroves and Sacred Groves

6.6 Mangroves forests serve as a link between terrestrial and marine ecosystem. Mangrove swamps in India are seriously endangered ecosystem. On the recommendation of National Committee on Mangroves, 32 mangroves areas in the country have been identified for intensive conservation and management. For sustained improvement and ecologically sustainable utilisation of coastal mangrove forest resources, it is essential to conserve the existing genetic wealth of mangroves as well as the genetic diversity prevailing within them. The distribution of mangroves in different states is shown in the Appendix 6.2

6.7 Mangroves are characteristic wetland biotic formation confined to traditional zones of land and the fresh water and marine aquatic ecosystems. In Kerala, mangroves are distributed along the fringes of backwaters and estuaries that are inter tidal zones of the Lakshadweep Sea. Mangrove formations are confined to mainly Kasaragod, Kannur, Kozhikode, Malappuram, Ernakulam, Kottayam, Alappuzha, Kollam and Thiruvananthapuram Districts in scattered bits.

6.8 Potential areas stands fragmented and actual area is estimated to be less than 50 km² which only is the remnants of about 700 km² of mangroves which reportedly existed in Kerala earlier. The developments of timber industry especially plywood, alternative land use and the establishment of fishing ports were the major reported sources for the degradation of the mangroves of Kerala. The mangroves are considered potential fish production sites providing breeding and nursery grounds for fishes and prawn. Moreover mangroves have innate potential to bind toxic chemicals and pollutants. Herons, storks, raptors and owls use mangroves as resting sites. Under the Important Bird Area programme (IBA), the Bombay Natural History society has prioritised the list of IBAs in Kerala. Apart from the forest areas, only Kole wetlands in Thrissur and Malappuram districts are included in this list. The areas selected under the IBAs should be given more thrust in birds conservation programmes. Even though the mangrove area in the state is insignificant compared to national coverage, the shrinking area has to be protected. The area under mangroves in different

states is shown in the Appendix 6.2. Action plan for the conservation of mangroves and strategy for its implementation to ensure community participation in conservation has to be prepared.

6.9 There are 14 true mangrove species in Kerala, mostly belonging to *Aegiceras*, *Avicenia*, *Brugiera*, *Ceriops*, *Kandelia* and *Rhizophora*, whereas mangroves associated species are quite diverse and many of them are also common in the terrestrial habitats also. Suitable interventions in the co-system, like assisted natural regeneration and artificial regeneration are therefore needed urgently.

6.10 Sacred groves have been reported from Afro-Asian Countries like Ghana, Nigeria, Turkey and Syria etc. They are found in abundance in eastern and western parts of India and are known by various names, viz. Kavu (Malayalam) Sarppakkavu (Tamil), Pavithravana (Kannada) Devarais (Marathi), Orans (Rajasthani) etc. and have extent varying from about 10 sq. kms to a million sq. kms.

6.11 The state of Kerala from time immemorial has nurtured a very divine and aesthetic line of protection of sacred groves, which was intermingled with religious ways of social activities and worships. Such sacred groves are to be protected from the angle of bio diversity also and the existing sacred groves are the only islands of conservation amidst vast stretches of degraded ecosystems apart from the forests.

Bio - diversity Conservation

6.12 Ever since the convention on Biological Diversity adopted at the UN Conference on Environment and Development (UNCED) at Rio de Janeiro in June 1992, there is great concern and commitment on the part of the international community for the conservation and sustainable and equitable utilisation of bio-diversity. Bio-diversity occurring in plants, animals and micro-organisms of economic value is now referred to as Agro bio diversity. The future of global food security depends on the success of our efforts in the conservation of agro-biodiversity. The developing countries in the tropical and sub-tropical regions are the richest, in terms of bio-diversity, but now worst affected with bio diversity loss. India, one of the 12 mega – diversity countries of the world is in the fore-

Box -6.2**Kole Wetlands – An Internationally Important Wetland in Peril**

Wet lands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Kerala by virtue of its extensive geographical extent, varied terrain and climatic conditions, supports a rich diversity of inland and coastal wetland ecosystems. Wet lands of Kerala include estuaries, deltas, mangroves, coastal lagoons, freshwater lakes, swamp forests, rivers, streams, ponds and non-managed systems such as rice fields and reservoirs.

The Indian Remote Sensing Satellite Data has shown that the state has a total wetland area of 127930.07 ha, in which 64 units covering an area of 34199.57 are inland wetlands and 93 units having an area of 93730.5 ha. are coastal wetlands.

Wet lands provide a wide variety of functions such as flood control, water purification, shoreline stabilisation, control of erosion and control of the hydrological cycle. They also prevent salt-water ingression from sea and enable ground water re-charge.

Kole wet lands is one of the largest and most important wetland of Kerala, covering an area of 13,632 ha. spread over Thrissur and Malappuram district, extending from the northern bank of Chalakkudy river in the south to the southern bank of Bharathapuzha river in the north. The area lies between 10° 20' and 10° 40' N latitudes and 75° 58' and 76° 11' east longitudes. The name 'Kole' refers to the peculiar type of cultivation practices carried out from December to May. 'Kole' a Malayalam work indicated bumper yield or high returns incase floods did not damage the crop. The rice cultivation in kole had been started early as 18th century by reclaiming the Thrissur 'kayal lands' by erecting temporary earthen bunds. The region generally experiences a moderate climate. The temperature varies from 21 to 38° C and the mean annual rainfall is 2757 mm. Kole wetlands is of substantial economic and cultural value and is regarded as the 'rice bowl' of central Kerala. It generates about 12,49,100 man days and an income of Rs.17,29,61,750/- annually.

Though it proved to be an internationally important wet land, kole wetland is one of the most threatened wetlands in the state. Reclamation of land and change in land use pattern are the most serious problems. The Paddy fields are being converted to Coconut, Arecanut and Banana and other cash crops at an alarming rate. The marshes are being 'developed' and new construction are cropping up. At many places, the wetland has been converted to brick-kilns. Large scale poaching and trapping of birds and fishing are also going on. The indiscriminate use of pesticides has been found to affect the migrant bird populations, which visits Kerala wetlands from September to April every year. Kole wetland harbours globally threatened species such as spot-billed pelicans, Oriental Darter, Black Headed Ibis, Painted Stork, Black-necked stork, Black bellied Tern, Cinereous vulture and Greater Spotted Eagle. From biodiversity conservation point of view also, 'kole' is of utmost importance.

It is suggested that conservation measures through a wetland Information System (WIS) and a participatory Wetland Management (PWM) Programme should get priority for environmentally sound sustainable development for all the wet lands in Kerala.

(Source: Proceedings of the 14th Kerala Science Congress, 2002)

front of the global bio-diversity crisis. India stands seventh in the World as far as the number of species contributed to agriculture and animal husbandry is concerned. The convention on biological diversity, the adoption of TRIPS, and an increasing trend towards privatisation of agricultural research have necessitated a new and complex policy environment for bio-diversity conservation.

6.13 In the last half of the century, the rich biological resources of the Asia Pacific region have been increasingly exploited both for international trade and to sustain the regions growing population. Overall habitat losses have been acute in India, China, Vietnam and Thailand. The rise of monoculture at the expense of local and wild varieties has resulted in the loss of genetic diversity. In Indonesia, around 1500 varieties of rice disappeared during the period 1975-90. Coastal biological resources have been depleted by excessive and unsustainable fishing activities. Pollution from shipping in particular and from discharge of toxic wastes has adversely affected the marine environment. South East Asia has also experienced among the highest rates of destruction of coral reef and mangrove habitats in the world.

Bio-Diversity Challenge in Kerala

6.14 Kerala represents an epitome of the bio-diversity profile of the Western Ghats in India. The state is endowed with diverse types of eco systems, each supporting unique assemblage of biological communities, with an impressive array of species and genetic diversity. The state represents 95 per cent of the flowering plants and 90 per cent of the vertebrate fauna of the Western Ghats.

6.15 The major obstacles to the conservation of bio-diversity are under valuation of living natural resources, ruthless exploitation of biological and genetic resources for profit, poor knowledge of species and eco-systems, insufficiency in using applied management practices, narrow focus of attention by conservationists and insufficient funding to institutions engaged in bio-diversity conservation.

6.16 At the present rate, the state of Kerala would have a population of 60 million by 2030. By that time $\frac{1}{3}$ of our bio-diversity would be extinct or they would remain in isolated refugia of non-viable population which may enter into the vortex of extinction. During

the 20th century, at least 50 plant species have become extinct in the country. Three species of birds – The *Himalayan Mountain Quail*, *Forest Spotted Owlet* and *Pink headed Duck* have become extinct. 69 bird species have been categorised as extinct. *Indian Cheetah* and *Lesser one horned Rhinoceros* are the mammals which are extinct. *Malabar Civet* is on the threshold of extinction and 173 species have been listed as threatened. Among flowering plants, about 1500 species come under threatened categories. The species diversity is shown in BOX 6.3.

6.17 One of the challenges of bio-diversity conservation is to locate areas of high concentration of endemic species so that critical endemic plant site can get priority for conservation. Nearly 23 per cent of the total endemic flora species are in Kerala. Out of the 1272 such species, 102 species occur exclusively in Kerala. The 5 endemic genera exclusively occurring in Kerala are *Chandrasekhararia* (Kannur), *Haplothismia* (Parambikulam hills), *Limnopoia* (Marshy wet lands of Northern Kerala), *Kanjarum* (Silent valley and Palakkad regions) and *Silent valleya* (Silent valley and other areas of Palakkad). There are 3 hotspots of endemic centres in Kerala – Agasthyamala, Anamalai High Ranges and Silent Valley – Wayanad. The details are given in Appendix: 6.3

Bio diversity Conservation Strategy

6.18 The ecologically sensitive areas have to be identified with reference to topography, hydrological regimes, and this has to be networked with species diversity. Catchment areas and coastal areas are two ecologically sensitive areas in Kerala. Land use planning of catchment areas with afforestation of native species through natural growth, Shola protections and aerial seeding with native seeds and closing the area from human interference for varying periods can help develop natural forests without much expenditure. This would enhance the bio-diversity of the area, allow soil conservation and increase the discharge of rain water without siltation into man made dams. Some of the highly critical areas of denudation of Sholas are seen in Agasthyamala, High Ranges of Idukki district and Wayanad belt in Malabar. The coastal areas of Kerala have become cesspool of pesticides and toxic materials discharged from agricultural operations at the high lands. Appropriate monitoring of pollution load in the rivers at the point of source can help the sustainable

Box -6.3**Species Diversity in Kerala**

- Kerala has a flora of 10035 species, which represent 22% of India's flora, occupying a landmass of just 1.18 per cent of the nation.
- There are about 3872 flowering plants and among them 1272 are endemic and 159 species have been classified under different threat categories .
- The flowering plants include about 1000 species of ornamental plants, 900 medicinal plants, 450 wild edibles, 175 gums, resins and dyes, 165 timber/wood species, 14 bamboo and reed, and 11 canes. Hardly, 10-15% of these plant resources has been exploited, while the rest remain as a potential gene pool as yet untapped. Among the resource species, medicinal plants are the most collected species from, the forests of Kerala.
- Out of the 300 RET species (Rare, Endangered and Threatened), in the Western Ghats, 159 are in Kerala; of which 70 are herbs, 23 climbers, 8 epiphytes, 15 shrubs and 43 trees. There are about 64 rare, 22 threatened, to endangered and 7 extinct Species.
- There are about 102 species of mammals, 476 of birds, 169 reptiles, 89 amphibians and 202 species of fresh water fishes reported from Kerala . There are about 56 species of mammals, 85 birds and 139 reptiles, recorded as endemic. Also there are about 86 amphibians recorded endemic and RET and 167 species of freshwater fishes as endemic/exotic/transplanted.
- The estimated number of elephants in the state is between 4290 and 7184, with viable populations at Wayanad, Thekkady, Parambikulam and Munnar regions. The estimated population of Guar in the state is around 4000. The tiger population is comparatively higher in Periyar and Parambikulam. Nearly 25 per cent of the Indian bird fauna is found in the state, of which 150 species have been located in the coastal area as and the remaining in the mid and high lands of the state. The endemic birds include *Nilgiri Wood Pigeon*, *Malabar Grey Hornbill*, *Wayanad Laughing Thrust*, *Nilgiri Laughing Thrust*, *Travancore White Breasted Laughing Thrust*, *Malabar Whistling Thrust* etc.
- A total of 10 species of fresh water fishes have been identified as 'most threatened' by NBFGR during 1992

development of fisheries and sanitation in the coastal belt. Some of the critical areas of coastal pollution occur in the belt from Neendakara to Aluva. The biodiversity of marine life of coastal areas is dependent on the control of pesticides use in the highlands. A strategic approach to bio-diversity conservation in Kerala as given by the French Institute of Pondicherry, the bio-diversity expert consultancy under the Kerala Forestry Project is given in BOX 6.4.

6.19 Since Kerala has the highest population density, it is prudent on the part of the local institutions/ panchayats to ensure conservation and management of protected areas with the active participation of people right at the grass root level

Biodiversity Action Plan

6.20 In line with the Biological Diversity Act 2003, Government has established Kerala Biological Diversity Board. The Board will encompass initially the following activities:

- (a) Development of state-wide strategy for implementing biodiversity programmes.
- (b) Preparation of an exhaustive inventory of the biodiversity based on genetic, species and ecosystem criteria.
- (c) Training programmes for Panchayat level committees to implement the action plan.

Box -6.4**Bio-diversity Conservation Strategy for Kerala**

- Create a network of research institutions (Institutes, Universities, Colleges and NGOs etc.), identify and conduct research on information gaps and create a Bio-diversity Information System for Kerala (BDISK)
- Conserve critical species, ecosystems and gene pools, with special reference to sacred groves, mangroves, wetlands and corridors.
- Develop comprehensive baseline information for management plans and monitoring, rationalize priority area network, create different management zones, identify and restore the degraded area, and develop monitoring designs and protocols for each activity.
- Create awareness among public to minimise the threats and to encourage sustainable utilisation of resources, develop appropriate environmental education policy and monitoring mechanism and create awareness among NGOs and other institutes, regarding financial support provided by Government of Kerala and Government of India through different schemes.
- Review the ongoing PFM and eco development initiatives, and extent them in all the forest divisions.
- Improve the capacity of frontline staff through training, workshop etc.
- Tackle the threats based on priority
- Establish a model for sustainable utilisation of resources for livelihood and equitable benefits such as cattle grazing, collection of firewood, grass and leaves for thatching and small poles, fishing and use of explosive in fishing, unsustainable and unscientific collection of NTFP etc.
- Develop comprehensive protection measures to tackle the illicit activities such as poaching, tree felling, encroachment, Ganja cultivation, illicit distillation, sand mining, quarrying and mining in private areas, potential bio piracy, Sandalwood smuggling etc.
- Mitigate human-wildlife conflict through appropriate methods.
- Minimize the impact of mass tourism and pilgrimage.
- Develop appropriate measures in natural resource management to mitigate management issues.
- Develop suitable institutional mechanism to minimize the constraints.

Source: Bio-diversity Expert Consultancy under KFP, 2003.

Bio-diversity Conservation and Panchayat Raj Institutions

6.21 With the active involvement of people, local self-governments can take up bio diversity conservation programmes. The state or centrally owned R&D institutions such as CESS, TBGRI, KFRI, CWRDM, NBPGR, NRCS can share their expertise to the local bodies in preparing and implementing various bio-diversity based, location specific projects. The NGOs working for grass root level conservation and development in Kerala can also play an important role in promoting the formulation and implementation of bio-diversity – based plans and programmes.

Land degradation

6.22 Of the World's 1.9 billion hectares of land affected by soil degradation during the last 45 years the largest area (around 550 million ha) is in the Asia Pacific region. This constitutes about 19 per cent of the regions total vegetated land.

6.23 According to the latest estimates, about 187.8 million ha (57% of land area) has been degraded in the country. Out of total estimated degraded land of the country, about 162.4 million ha is due to displacement of soil material by water and wind and 21.7 m ha. is due to insitu processes as salinity and water logging. The remaining 4 m ha. is affected by the depletion of nutrients. Soil erosion accounts for 87 per cent of the total degraded land in India. Non adoption of proper soil and water conservation measures, in proper crop rotation and extension of cultivation on to lands of high natural hazards are some of the important reasons contributing to soil erosion.

6.24 Land degradation in the State varies in nature and magnitude. The degraded land in the state is shown in Table.6.2 Around 10 lakh ha is prone to moderate to severe soil erosion in the state.

Table 6.2
Land Degradation in Kerala

Sl. No.	Category	Area (Lakh Ha)
1	Soil erosion – Moderate to severe	9.52
2	Control water logging and salinity	0.76
3	Degraded forest	1.98
4	Semi stream bank erosion	1.00
5	Land slides	1.00
6	Sea erosion	0.50
7	Total	14.76

6.25 The indiscriminate and unscientific soil and water management have made a major portion of land to be erosion prone. The undulating topography with high intensity of rainfall cause the high rate of soil erosion.

6.26 The annual loss of soil accounts to nearly 5 billion tonnes, of which 3.2 billion tonnes (64%) is contributed by highly eroded to very severely eroded areas such as Shiwalik hills, the Western Ghats, black and red soil areas and the north Eastern states. In more than three quarters of the area that suffers from soil erosion, productivity is lowered by 5 per cent to more than 50 per cent. Of the annual loss nearly 29 per cent is permanently lost to the sea, about 10 per cent is deposited in reservoirs thereby decreasing their storage capacity by 2 per cent annually and the remaining 61 per cent is merely displaced.

6.27 It is estimated that on an average annual rate of soil loss is at 16.35 tonnes/ha ICAR has initiated the

preparation of soil erosion maps of different states using the Universal Soil loss equation. Soil nutrient mining results in serious soil health and ecological problems, which needs urgent attention. Double and municipal water, sledges, pesticides, industrial water etc. need to be used with utmost care to avoid the possibility of pollution by the soil through heavy metals.

6.28 High erosion rates have resulted in the sedimentation of river banks, siltation of drainage channels, irrigation canals and reservoirs. The storage capacity of many reservoirs has been reduced drastically due to accelerated erosion. The Ganga and Brahmaputra carry the maximum sediment load, about 586 and 470 million tonnes respectively every year.

6.29 The siltation rate of reservoirs in India has been estimated to be much higher than the values assumed at the time of designing. Against the designed rates of siltation (tonnes/ha/year) of 0.29 (Nizamsagar) to 4.29 (Ramganga), the actual siltation rates varying from 6.57 (Nizamsagar) to 17.3 (Ramganga). The annual sediment load flow into many reservoirs range from 0.6 to 122.7 ha - m/10,000ha. The results of sedimentation surveys in some of the reservoirs in the state are shown in Table 6.3. The reduction in capacity of various reservoirs ranged from 4.18 per cent in Pamba to 30.9 per cent in Anayirankal reservoir.

Salinisation

6.30 Salt affected soils are widespread in the Arid, semi-arid and sub humid zones of the Indo-gangetic Plain. About 7 m ha. is salt affected, of which 2.5 m ha. represent the alkali soil in the Indo gangetic plain. According to FAO, the loss in crop production due to

Table 6.3
Summary of the Results of Sedimentation Surveys

Sl. No.	Reservoir	Capacity (Mm ³)		Reduction (%)	Annual reduction (%)	Sediment yield (m ³ /ha/yr)
		Original	Present			
1	Kallarkutty	6.87	6.14	11.00	0.37	8.39
2	Sengulam	NA	1.87			
3	Ponmudi	51.66	40.05	21.60	0.72	13.00
4	Peringalkutu	32.00	23.84	26.60	0.71	4.43
5	Mattupetty	55.22	48.78	11.66	0.26	13.34
6	Kundala	7.76	6.49	16.20	0.35	7.11
7	Anayirankal	49.80	34.40	30.90	0.94	71.05
8	Pamba	39.20	37.56	4.18	0.13	7.10

Source : CWRDM

salinity in India accounts to 6.2 million tonnes.

6.31 Kerala endowed with a high ecological diversity has so many inherent problems associated with different soil types. The state with its long coastal line of about 590 km, has 16 lagoons or backwaters, covering an area of about 650 square km linked to the sea. Most of the coastal lands, deltaic areas at river mouths and reclaimed backwaters are either at sea level or 1.0 to 1.5 m below sea level. This leads to intrusion of seawater, which makes the soil saline. The other reasons of soil salinity are saline ground water, seepage from canal and higher adjacent areas, poor surface and subsurface drainage, saline irrigation water and industrial effluents. Saline soils contain excess amount of soluble salts in the root zone and adversely affect crop growth due to osmotic stress.

6.32 Based on the location, extent and intensity of salinity, 3 types of saline soils are recognized in Kerala. They are : (1) Pokkali lands, known after the Pokkali cultivation; (2) Oorumundakan lands, known after the long duration variety of rice grown there and (3) Kaipad lands. The Pokkali lands are located between the Thanneermukkam and Enamakkal bund, ie. in the coastal areas of Ernakulam and Thrissur districts, mostly distributed in Cochin, Kanayannur, Paravur, Thrissur and Kodungalloor taluks. Oorumundakan lands of Alappuzha and Kollam districts are mostly distributed in Sherthalai and Ambalappuzha taluks. Kaipad lands are situated in the low lying deltaic area of river mouths in Kannur district. The different types of saline land together constitute an area of about 30,000 ha.

6.33 As distinct from the saline soils found in other states, the origin, genesis and development of these soils in the state are under peculiar climatic and environmental conditions. These soils comprise of low lying marshes near the rivers and streams, water logged and ill drained and are subjected to tidal waves. These lands in their original natural state had been overgrown with mangrove and other salt loving plants, but it is difficult to identify such areas now. These areas are cropped with paddy once in a year from June-July to October-November, when the salinity level in the surface soils is brought below the critical level by Monsoon showers. However, when salinity is partially washed off by rain water and fresh water from rivers, the inherent acidity of these soils become more dominant. Recla-

mation of saline soils involve leaching and drainage. Traditional agricultural practices are followed in these lands. focussed action Plan has to be prepared to utilise the land on sustainable basis for crop production

Mining and Quarrying

6.34 Resource extraction through mining and quarrying activities degrades the environment in various ways. The process of environmental deterioration begins with the resource extraction activity and results in land and water degradation, expressed in terms of increased soil erosion, changes in landscapes, hydrological imbalances, water pollution etc. The various mining/quarrying activities include sand mining from the river channels and over bank areas, soil quarrying, hard rock mining, laterite mining, brick clay mining etc.

6.35 Unlike the rivers of our neighbouring states, the rivers of Kerala are too small in their size and resource capability. River sand is an essential raw material for building construction and an alternative is yet to be found out. This has imposed mining of sand several folds higher than the natural replenishments. Sand mining changes the physical characteristics of the river basin, disturbs the closely linked flora and fauna and alters the hydrology and soil structure. Due to the non-availability of sand in the river channel, now the attention has been shifted to the riverbanks and flood plains. This results in slumping/caving and widening of river banks, increase the percentage of fine particles in the fluvial environment, decline in water table and saline water intrusion in to the wells of adjacent areas . Flood plain mining in the paddy fields after removing the top clay layer will have a direct bearing on the local hydrological regime and ground water movements. Studies show that about 168 MT of sand is being mined per day from 8 Panchayats in the Neyyar river basin, involved in flood plain mining. There are about 320 sand mining locations in the Periyar river basin in the central Kerala with a total of 39 local bodies involved in sand mining, to mine about 8372 M³ (2093 truck loads) each day. At this present rate of mining, the entire sand resource in the Periyar River would be exhausted within a decade, apart from other environmental implications. A study by CESS reveals that many of the fish fauna as well as other aquatic organisms of Ithikkara river is under threat due to loss of habitat, feeding and breeding grounds, decline of food, aggravated salt water ingression etc. resulted out of indiscriminate sand mining.

6.36 The soil quarrying, mainly done for construction sector and paddy land reclamation, degrades the soil with loss of nutrients, microorganisms. Now clay mining in paddy fields is taking place at an alarming rate, mainly for brick making. A survey on the Neyyar basin shows that 20 per cent of the paddy fields have been altered for clay mining. Apart from the land degradation problems, clay mining also leads to lowering of ground water level.

6.37 Hard rock mining is also another environmental issue in many parts of the state. Since the hard rocks are not a renewable resource, its uncontrolled quarrying may end up in irreversible changes in the environment.

Coastal Zone

6.38 The Government of India notification in 1991 has declared 500m of land from the High Tide Line as a Coastal Regulation Zone (CRZ) on the counts of seas, estuaries and backwaters. The State Coastal Zone Management Plan has set the regulation zone to 100 m or wherever the width of the kayal is less than 100m, a distance equal to its width. Activities such as starting of new industries, dumping of wastes, reclamation etc. are prohibited. Construction of bridges is permissible. Environmentally sensitive areas like mangrove ecosystem, fish spawning and breeding areas are protected by prohibiting all types of construction activities.

6.39 Kerala State Coastal Zone Management Authority (KCZMA) has been constituted in January 2002 for a period of three years under the Chairmanship of Chairman, State Council for Science and Technology with nine members. The authority has the powers to examine the proposals for changes or modifications in classification of coastal regulation zone areas and in the coastal zone management Plan and making specific recommendation to the National Coastal Zone Management Authority.

6.40 The Authority shall have the power to take measures for protecting and improving the quality of the coastal environment and preventing, abating and controlling environmental pollution in the coastal areas of the State.

6.41 The KCZMA examines application for development projects in the coastal areas and issue clear-

ances for the deserving cases based on the CRZ Act 1991 and its subsequent modifications. It also deals alleged violations of the provisions of the Act and making specific recommendations to the National Coastal Zone Management Authority, Govt. of India.

Water Quality

6.42 Water quality has been steadily degraded by a combination of factors, including saline intrusion, sewage and industrial effluents. and urban and agricultural run off. Biochemical Oxygen Demand (BOD) in Asian rivers is 1.4 times the World average and 1.5 times OECD levels. Dirty water and poor sanitation causes more than 500,000 infant deaths a year in the Asia-pacific region.

6.43 High fluoride concentration in ground water beyond the permissible limit of 1.5 ppm has come to stay as a major issue affecting a large segment of rural population to the tune of 25 million spread over more than 200 districts in 17 states in the country. The population at risk is estimated at around 66 million, Hand pump attached defluoridisation and iron removal plants have failed due to inappropriate technology, unsuited to community perception and community involvement.

6.44 The presence of excess Arsenic in ground water has been reported from West Bengal. Nearly 13.8 million people in 75 blocks are reported at risk. it is also reported that around 0.2 million people in West Bengal have arsenic related skin manifestation. Statewise water quality status is shown in Appendix - 6.5

6.45 Over the last decade industrial waste and municipal waste have emerged as the leading causes of pollution of surface and ground water.

Ground Water Quality

6.46 The presence of fluoride in ground water in concentrations above permissible limits (1.5 mg/l) is reported in certain pockets of Attappady and Chittoor area of Palakkad and Alappuzha districts. The salient findings of a study on fluoride concentration in Ground water in Alappuzha is shown in BOX. 6.5 Earlier study conducted in the area in 1985-88 also showed fluoride concentration in the range of 0.32 to 2.62 mg/l in deep tube wells which indicate stable presence of fluoride in ground water. The studies conducted by State Ground water department also confirmed the presence

Box -6.5**Major Findings of a Study on Fluoride in Alappuzha**

- Water in the phreatic aquifers is very low in fluoride and is in the range of 0 to 0.4 mg/l and water in shallow tube wells tapping phreatic or semi-continued aquifers is also low in fluoride and is in the range of 0.002 to 0.36 mg/l.
- Water in the deeper tertiary aquifer is high in fluoride and is in the range of 0.453 to 2.66 mg/l. In 70 per cent of the water supply wells, the fluoride concentration is more than 1 mg/l and in 40% of the wells it is more than 1.5 mg/l.

Source: CGWB, 2003

of high fluoride in Ground water. Apart from regular monitoring, minimisation of fluoride by mixing low fluoride water with high fluoride water from water supply wells, use of PVC pipes, to avoid corrosion and technologies developed by NEERI etc. could be followed in the region. The legal framework for regulatory withdrawals of ground water is now in place. The frequency of monitoring and number of monitoring stations also is not representative of the quality of water body specifically in the non-monsoon period.

Surface Water quality

6.47 Water in various stretches of rivers like Periyar, Chaliyar and Bharathapuzha are polluted with various contaminants of domestic, agricultural and industrial origin. While colour and relatively high Bio chemical Oxygen Demand (BOD) are the reported problems in Chaliyar, traces of mineral oil and organic chlorine Pesticides and salinity on the stream side are the problem of Bharathapuzha. Major findings of a study by CESS is shown in BOX 6.6

6.48 The Central Pollution Control Board has been monitoring water quality in collaboration with State Pollution Control Boards at 507 locations. Water quality monitoring results indicate that organic and bacterial contamination still continue to be critical sources of pollution in Indian aquatic resources. The unsystematic use of fertilisers coupled with improper waste management has affected the ground water quality in many parts of the country. Also recorded high concentration of heavy metals, fluoride and nitrates at different locations around the country.

6.49 Under the National River Action Plan, certain stretches of major rivers with high or intermediate levels of pollution were identified by the CPCB. Pampa action plan is also included under the project. To focus on urban lakes, the National Lake Conservation Plan was initiated.

Box -6.6**Major Findings of a Study on Selected Rivers of Kerala****Killiar**

- High nitrate and ammonia content in the upper reaches of Killiar
- The total coliform count at monitoring stations were above 4 count/ml which exceed the permissible limit.
- High total suspended solids observed in lower reaches of Killiar.

Kallada and Ithikkara rivers

- In addition to bacterial contamination, salinity is found to be a major problem in these rivers. The intrusion of salinity is taking place upto 6 kms. in Kallada and up to 4 kms. in Ithikkara from the lower reaches.

Pampa river

- Chemical quality of the water in general is good but has severe microbiological problems.
- The faecal coliform in Water samples was found to be higher during pre monsoon seasons.

Source: CESS

Box -6.7**Environmental Impact of Retting Activity in the Wetland Ecosystems of Kerala**

The 590 km coastal belt of Kerala is unique, having 30 wetland ecosystems popularly known as back waters. Retting of Coconut husk in the wetlands of Kerala, is a major source of pollution, leading to deterioration in environmental quality and production potential.

A study conducted by Central Inland Fisheries Research Centre (ICAR), Alappuzha (1997-99), in 10 'hot spots' of the wet land ecosystems – *Neeleswaram, Valapattanam, Mahe, Ponnani, Chettuva, Kodungallur, Kayamkulam, Ashtamudi, Anchuthengu and Kadinamkulam*, has revealed that Coconut husk retting is converting the wetland ecosystem into a curious and complex eco-system of micro aerobic and an aerobic properties. The large scale reclamation of the wetlands due to dumping of husk, coir pith and related materials, has resulted in horizontal and vertical shrinkage of the water bodies. Retting activity has led to acidic pH conditions with anoxia resulting in the production of high amounts of Sulphide, coupled with high Carbon dioxide values leading to drastic reduction in the incidence and abundance of Plankton, benthic fauna and fishery resources. Of the 10 wetlands studied, Kadinamkulam and Anchuthengu were found to be the most impacted from the retting activity. The study has recommended to adopt the following management strategies.

- To keep the estuary mouth (Pozhi) permanently open, allowing continuous flushing and uninterrupted sea/estuary interaction, to avoid deterioration in water quality and the consequent damage to aquatic organisms.
- To entrust the local panchayats for licensing of the retting areas and form a local committee comprising of government representatives, local people and technical personnel to advise the government on retting operations.
- To close the worst hit areas for retting activity for a few years, allowing their ecological restoration.
- To allow retting of coconut husks in specially constructed tanks with facility for aeration and partial flushing.
- To conduct studies on the carrying capacity of each back water in the context of number of husks that can be soaked, which will inturn enable for regulating the quality of husks.
- To apply an environmental friendly approach of bio-remediation process, in the retting zones to detoxify and control the major pollutants-organic pollutants, high amounts of H₂S and low dissolved oxygen levels.
- To undertake a bio technological approach, an advanced form of the re mediation process, to control pollution from the retting activity.

(Source: *Proceedings of the 14th Kerala Science Congress, 2002*)

Industrial effluents

6.50 A number of industries situated on the banks of rivers and backwaters discharge their effluents into the wet land system. These effluents contain a large number of toxic ingredients such as acids, alkalies, heavy metals, suspended solids and a number of other chemicals. Among various industrial pollutants, heavy metals require special considerations due to their non degradable nature. Analysis of particulate metal content indicates high concentration of Zinc, Cromium etc due to industrial pollution in Kochi backwaters. Details of in-

dustries in Periyar river basin is shown in the Appendix 6.6 Highest concentration of heavy metals in sediments was observed during pre monsoon. Chromium content was higher in Ashtamudi and Vembanad and mercury content was high in Vembanad.

Air Pollution

6.51 The extent of air pollution varies considerably across Asia. The major causes of increasing air pollution are increasing energy demand and

consumption, the use of poor quality fuels such as coal with high sulphur content, inefficient methods of energy production and use, increasing number of vehicles, traffic congestion, poor automobile and road conditions, use of leaded fuel, resulting in emission of sulphur dioxide, nitrogen oxides, suspended particulate matter, lead, carbon monoxide. Forest fires also contribute to the air pollution. Per capita emission of Carbon dioxide is little more than half the world average in Asia. In 1990, China and Japan became the first and second largest Carbon dioxide emitters in Asia which is 15 per cent of the level in OECD countries.

Green House Gas Emission

6.52 Carbon dioxide emission largely a by product of energy production and use account for the largest share of greenhouse gases which are associated with global warming. Kyoto protocol marks the first international attempt to place legally binding limits on green house gas emissions from developed countries. In addition to carbon dioxide, the primary green house gas emissions from developed countries. In addition to carbon dioxide, the primary green house gas, the protocol focuses on five other green house gases are targeted for reduction. Developed countries are the major contributors of green house gas emissions. The per capita emission of carbon dioxide is shown in Table 6.4. The average percapita emission in

India was 1.1MT, while it was 19.7 MT in USA and 18.2 MT in Australia in 1999.

6.53 Action Plan is needed on mitigation and control of air pollution and GHG emission in urban cities through reducing traffic congestion, proper land use planning and switching over to cleaner fuels like CNG. Development of institutional, technical and human capabilities to monitor air pollution and GHG emission, promotion of public awareness of air pollution are needed.

Bio-Fuel

6.54 The gases emitted by petrol and diesel driven vehicles have an adverse effect on the environment and human health. There is universal acceptance of the need for reducing such emissions.

6.55 The rationale of taking up a major programme for the production of bio-fuels for blending with gasoline and diesel in our country emanates from a variety of factors. First, there is no alternative to the petroleum based fuels i.e., motor spirit or gasoline and High Speed Diesel (HSD) for the transport sector which is the major consumer of petroleum products. Secondly, Bio-fuels are environmentally superior fuels and their use becomes compelling if the prescribed emission norms are to be achieved. Thirdly, there is need to meet the global environmental concern about climate change. The major recommendations of the Committee on Development of Bio-fuel is shown in the BOX.6.8.

6.56 Traffic planning and management assume importance in reducing pollution. Greater promotion of and use of alternative fuels cleaner technologies such as CNG, LPG, curbing fuel adulteration, fiscal incentives for pollution prevention and control measures, appropriate siting of industries, strengthening of emission standards, replacement of two stroke engines, awareness programmes, appropriate design of green belt are needed. An effective environment management plan should be devised covering regulation, capacity building, environment strategy by involving NGOs, PRIS, line departments and private sector.

Table 6.4

Carbon dioxide Emission in Different Countries

Sl.No.	Country	Carbon dioxide emission/capita (MT)	
		1990	1999
1	India	0.8	1.1
2	China	2.1	2.3
3	Malaysia	3	5.4
4	Philippines	0.7	1.0
5	Sri Lanka	0.2	0.5
6	Thailand	1.7	3.3
7	UK	9.9	9.2
8	USA	19.3	19.7
9	Vietnam	0.3	0.6
10	Japan	8.7	9.1
11	Indonesia	0.9	1.2

Source : World Development Indicators 2003

Box -6.8**Major Recommendations of the Committee on Development of Bio Fuel****Recommendations on Ethanol**

- Ethanol may be manufactured using molasses on the raw materials.
- Imported ethanol should be subject to suitable duties so that domestically produced ethanol is not costlier than the imported one.
- Buyback arrangement with oil companies for the uptake of anhydrous alcohol should be made.
- To reduce cost of production, provision of incentives for new economic sized distilleries, technology integration of distillery with sugar plant, Economics of ethanol production from other feed stocks such as sugar beet, corn, potatoes etc. should be studied.
- Blending of ethanol with motor spirit needs to make a very modest beginning to be raised to 10%.

Recommendations on Bio Diesel

- A National Mission on Bio diesel should be launched with the objective of producing by the year 2011-12 Bio diesel enough to enable its blending with HSD to the extent of 20%
- A demonstration project be taken up in a mission mode with micro mission.
- Ministry of Rural Development may take up plantations under the IWDP and other poverty alleviation programmes. Department of Rural Development, Department of Land Resources and CAPART will be responsible for plantation in degraded and waste lands.
- After the completion of the Demonstration Project in, Phase II, Government should act as a facilitator, providing policy.

Source : Planning Commission

Vehicular Pollution

6.57 The quantum of vehicular pollutants emitted is highest in Delhi followed by Mumbai, Bangalore, Calcutta and Ahmedabad. Carbon monoxide and hydrocarbon account for 64 per cent and 23 per cent respectively, of the total emitter load due to vehicles in all these cities considered together. Given the increased usage of diesel it becomes necessary to reduce its sulphur content. Fuel quality specification have been laid down by the BIS for gasoline and diesel for the period 2000-2005.

6.58 The high influx of population to urban areas, increase in consumption patterns and unplanned urban and industrial development have led to the problem of air pollution. Air pollution is widespread in urban areas where vehicles are the major contributors - Road based Passenger transport has recorded high growth since 1980-81 in the country. The slow growth of road infrastructure and high growth of transport per-

formance and number of vehicles implies that Indian roads are reaching a saturation point in utilising the existing capacities.

6.59 A recent study showed that pollution is concentrated among a few industrial sub sectors and that a sector's contribution to pollution is often disproportionate to its contribution to industrial output. Petroleum refineries, textiles, pulp and paper and industrial chemicals produce 27 per cent of the industrial output in the country, but contributes 87 per cent of sulphur emissions and 70 per cent of nitrogen emission from the industrial sector. Likewise, iron and steel and non-metallic mineral products, produce about 16 per cent of the industrial output, but account for 55 per cent of the particulate emission.

6.60 Environmental concerns have assumed significance in the recent years. Commensurate with industrial expansion, a strong regulatory mechanism is re-

quired to ensure minimum environmental standards. Pollution control efforts in 17 high polluting industries in various states is shown in Table 6.6. Out of the total 1,551 large and medium industrial units identified in 1992 in the country in the 17 categories of highly polluting industries, 1,349 industrial units have installed the requisite pollution control equipment, 179 units

have been closed down and 23 units have yet to install the necessary pollution control facilities (as of June,30, 2002). Legal action has been taken against all defaulting industrial units. In Kerala out of 28, 6 are closed and 22 are having adequate facilities to comply with the standards (Table-6. 5)

Table - 6.5
State wise Summary Status in 17 Categories of Industries
(as per information available with CPCB as on June 30,2002)

State	Total No. of Units	Status (No.of Units)		
		Closed	C#	Defaulters ##
Andhra Pradesh	173	29	143	01
Arunachal Pradesh	00	00	00	00
Assam	16	03	11	01
Bihar	44	19	25	00
Chandigarh	16	01	14	01
Goa	06	00	06	00
Gujarat	177	07	170	00
Haryana	43	06	37	00
Himachal Pradesh	09	00	09	00
Jammu & Kashmir	08	03	05	00
Jharkand	18	03	13	02
Karnataka	85	09	76	00
Kerala	28	06	22	00
Maharashtra	335	24	306	05
Madhya Pradesh	62	11	48	03
Meghalaya	01	00	01	00
Manipur	00	00	00	00
Mizoram	00	00	00	00
Nagaland	00	00	00	00
Orissa	23	03	16	04
Punjab	45	06	39	00
Rajasthan	49	06	43	00
Sikkim	01	00	01	00
Tamil Nadu	119	02	117	00
Tripura	00	00	00	00
UT-Andaman & Nicobar	00	00	00	00
UT-Chandigarh	01	00	01	00
UT-Daman & Diu, Dedra & Nagar	00	00	00	00
UT-Lakshadweep	00	00	00	00
UT-Pondicherry	06	01	05	00
Uttaranchal	17	00	17	00
Uttar Pradesh	207	22	182	03
West Bengal	58	17	38	03
Total	1551	179	1349	23

Having Adequate Facilities to comply with the Standards

Not having adequate facilities to comply with the Standards

Source: Economic Survey 2002-03

Ambient Air Quality

6.61 The annual average minimum and maximum Suspended Particulate Matter concentration in residential areas of various cities ranged from 60 $\mu\text{g}/\text{m}^3$ at Bangalore during 1991 to 521 $\mu\text{g}/\text{m}^3$ at Patna during 1995, while in Industrial areas the annual average ranged between 53 $\mu\text{g}/\text{m}^3$ in Chennai during 1992 and 640 $\mu\text{g}/\text{m}^3$ in Calcutta during 1993. The mean average value of SPM for nine years (1990 to 1998) ranged between 99 $\mu\text{g}/\text{m}^3$ and 390 $\mu\text{g}/\text{m}^3$ in residential areas and between 125 $\mu\text{g}/\text{m}^3$ and 457 $\mu\text{g}/\text{m}^3$ in industrial areas indicating that the annual average limit of suspended particulate matter for residential areas (140 $\mu\text{g}/\text{m}^3$) and for industrial areas (360 $\mu\text{g}/\text{m}^3$) had been frequently violated in most cities. Low values have been recorded in Chennai, Bangalore and Hyderabad.

6.62 Monitoring of ambient air quality is considered to be a vital component in the Environmental Impact Assessment. The Central Pollution control Board has established a national Ambient Air Quality Monitoring Net work (NAMP) in collaboration with the State Pollution Control Boards, comprising of 290 stations in 92 cities/towns, to collect, compile and disseminate information on air quality.

6.63 The Kerala State Pollution Control Board

(KSPCB) monitors the ambient air quality at 19 stations in the state, of which 11 come under NAMP and the rest under State Ambient Air Quality Monitoring Programme. The KSPCB also has 2 mobile sampling units. The relative air quality situations at four major locations in the state are given in Table-6 6.

6.64 The Ministry of Environment and Forest, Government of India has identified Kochi as one of the areas with very high pollution potential.

Air Pollution and Health Impact

6.65 The air is highly polluted in terms of suspended particulate matter in most cities. This has led to a great incidence of associated health effects. Recent epidemiological studies have shown that smoke and dust particles, especially smaller particles below 10 microns in diameter and in particular the finest particles below 2.5 micron in diameter significantly affect human health.

6.66 As per a study report, respiratory infectious disease contribute to 11 per cent of the total burden of diseases, while cerebro vascular disease (2.1%), ischemic heart disease (2,8%) and pulmonary obstruction (0.6%) are much lower. The prevalence of Cancer is about 4.1 per cent amongst all the diseases indicating that the effects of air pollution are visualised on the urban population.

Table 6.6 :
Air Quality Levels in Selected Locations of Kerala

Pollution Standards	Annual Mean Concentration Range ($\mu\text{g}/\text{m}^3$)					
	SO ₂		NO ₂		SPM	
	Industrial	Residential	Industrial	Residential	Industrial	Residential
Low (L)	0-40	0-30	0-40	0-30	0-190	0-70
Moderate (M)	40-80	30-60	40-80	30-60	180-360	70-140
High (H)	80-120	60-9-	80-120	60-90	360-540	140-210
Critical © 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 : CPCB

Box -6.9**Traffic, the major cause of Noise Pollution**

Increasing urbanisation, high-density traffic and rapid industrialisation in the past two decades have recognised one more potential air pollutant –Noise. The problem of noise pollution has now reached such a significant dimension, that in India, noise is included in the Air Act (Prevention and Control of Pollution) amended in 1987.

In Kerala, noise pollution is reaching an alarming level, at Kochi, which is the industrial capital of the State. A study conducted by the School of Environmental Studies, Cochin University of Science and Technology has revealed that, the noise levels are high both during day and night time in the central part of the city, with the commercial areas showing the maximum values. The average day time noise at the District Hospital was 66 dB, which is 16 dB higher than the limit. Only in industrial areas and residential areas away from the city centre, it is within limits. The noise level at Thrikkakkara, which is far away from the city, was 10dB more than permissible limits during peak hours. Traffic has been identified as the major cause of noise pollution.

(Source: Proceedings of the 14th Kerala Science Congress, 2002

Carrying Capacity Based Planning

6.67 The carrying capacity based planning approach ensures meeting the objectives of development without impairing ecological health and also it has potential for generating alternatives for future anthropogenic life supporting activities. A study was conducted in greater Kochi Region co ordinated by NEERI in asso-

ciation with seven institutions. The study area accounts for 34 per cent of total geographical area of Kerala covering Ernakulam, Iddukki and Kottayam and parts of Alappuzha, Pathanamthitta and Thrissur. The major findings of the study are shown in BOX 6.10 Environmental value of growing stock is shown in the Appendix. 6.7

Box -6.10**Major Findings of Study by NEERI on Carrying Capacity based Development Planning for Greater Cochin Region**

- Air quality index estimated for different seasons showed that that the air quality in the region falls under the category good and excellent. During the study period
- Ambient noise levels recorded in the study region were found to be more or less within the exposure limits. However occasionally high levels were observed due to surface as well as transportation activities and aquatic avi fauna was found to be affected.
- Water quality in seven rivers- Chalakkudy, Periyar, Muvattupuzha, Meenachal, Manimala, Pamapa and Achancoil flowing through the region was in general satisfactory falling under B category of CPCB classification.
- Total coliform was found to be much higher than the permissible limits
- Aluva-Eloor and Ambalamedu area have been identified as hot spots due to ground water problems with reference to heavy metals, nitrates and fluoride.
- Idukki has more capacity to assimilate pollutants than other districts due to higher wind speed
- Air in Kottayam and Alappuzha can assimilate emission load up to 24 MT/day
- The assimilation capacity of air environment in southern part of Ernakulam is unutilised. Locating new industries in this region will help in sustainable development of the region.
- The estimate of industrial effluent discharged into the backwaters including industrial and municipal waste is about 1,04,000 m³/day. Assuming BOD load as 50 mg/l, the total BOD loading is about 5200 kg/day, the estimated assimilative capacity is about 25920 kg/day. This indicates that the effluent presently discharged into the backwaters system, if discharged at 10 m depth in the coastal waters can be easily assimilated.

Source: NEERI 2002

6.68 India has adopted the Air (Prevention and control of Pollution) Act 1981 and also adopted the Male declaration on control and prevention of air pollution and its likely transboundary effects for South Asia in April 1998.

6.69 Guidelines for siting industries are prescribed so that the possible adverse effects on the environment and quality of life can be minimised. EIA is mandatory for 29 specific activities/projects and also for some of the activities to be taken up in identified areas such as the coastal zone. The carrying capacity based regional planning studies has to be extended to more areas. The CPCB has laid down the maximum permissible limits for different pollutants for many categories of industries that contribute to air pollution. The standards have been notified by MOE under the Environment (Protection) Act 1986. Submission of an environmental statement by polluting units to the State Pollution Control Board concerned has been made mandatory under the Act.

6.70 In order to delineate the areas that are suitable for industrial siting, district wise zoning atlas project has been taken up by the CPCB and industrial zones are identified based on the sensitivity and pollution receiving potential of the district.

Activities of State Council for Science , Technology and Environment

6.71 The Kerala State Council for Science, Technology and Environment (STEC), has been playing a catalytic role in applying Science and Technology for the developmental process of the State. Implementation of "National Green Corps (NGC)" a programme under the Ministry of Environment and Forests, Government of India is being co-ordinated by STEC, through a network of eco clubs established in 1400 schools in the State. A National Environmental Awareness Campaign was also co-ordinated by STEC, during 2002-03 with the focal theme 'water-the Elixir of Life'. STEC has also celebrated the World Environment Day,, 2003 on 5th June, 2003, with "Water – 2 Billion People are dying for it" as the focal theme. A compendium on 'Fresh Water Resources of Kerala' was also released by STEC on that day.

Environmental regulations

6.72 India is having a comprehensive environmental legislation regarding pollution control. There is a spot of environmental legislature starting from early 1970, viz. Wildlife Protection Act (1974), Water Cess Act (1977), Forest Conservation Act (1980), The Air (Prevention and Control of Pollution) Act (1981), Environment (protection) Act (1986) Water (Prevention and Control of Pollution) Cess Act (1988) and Public Liability Insurance Act (1991). The water (Prevention and Control of Pollution) Act and the Air (Prevention and Control of Pollution) Act are now referred to as Water Act and Air Act.

6.73 The Air Act, Water Act and the Environment (Protection) Act, set the national standards for air and water quality. The actual standards are laid down by the CPCB (1995), in consultation with institutions such as National Environmental Engineering Research Institute (NEERI), in Nagpur. The standards termed 'Minimum National Standards' (MINAS) are designed for the country as whole, although individual states have the option of making them more stringent.

6.74 In addition, the EPA of 1986 gives powers to the Central Government to pursue any means deemed necessary to protect and improve the quality of the environment, including co-ordination of the activities of the various state governments.

6.75 India currently has relatively weak institutions and infrastructure and the master planning approach was not able to curtail congestion, pollution, marginalisation of the poor and other serious environmental situations. Added to this is the lack of co-ordination between different agencies responsible for various urban tasks within a city. Sewage, drainage and solid waste services are often the responsibility of different agencies. The poor revenue situation of urban local bodies has contributed to the failure in urban planning. Eventhough a number of environmental Acts and rules are in force, the enforcement levels are relative unsatisfactory. An overview of the environmental legislation and executing authorities are given in Appendix-6.8.

Path Ahead

6.76 Institutions involved with environmental governance and protection are to be strengthened in the

state. The State Council for Science and Technology and Environment and Kerala State Pollution Control Board are the leading agencies in the state in the environment sector. However environment warrants a multi agency involvement. More co ordination with implementing agencies as well as linkage with local governments would go a long way in achieving the desired results. An integrated environmental management system is required to be established in the State, in order to protect the environmental resources and to implement better pollution control, setting up of an appropriate legal, institutional and administrative framework equipped with all required powers skills and operation is the first requirement for developing state wide environment management. Evidently, functional co-ordination between different agencies responsible for various tasks is essentially required.

6.77 State environmental action plan needs to be prepared in a time bound manner for implementation in collaboration with LSGs, NGOs and Private sector.

6.78 Even though environmental education is included as part of school curriculum, more topics related to the State have to be included. Environmental education has also to be made a compulsory topic in teacher training programmes. Environmental journalism is also needs strengthening to be given much focus in media coverage.

6.79 The Environmental Information System Network (ENVIS) is a notable example of the collection, collation and dissemination of environmental data and information. The recent initiative of the State council for Science technology and Environment to establish an ENVIS centre is a step in the right direction.

6.80 Regular publication of environmental indicators such as water and air quality levels and environmental information bulletins are essential for building a sustainable environmental framework .

6.81 Incentives and disincentives are to be used as economic instruments to promote environment conservation and efficient resource use. Incentives are mostly taxation oriented and disincentives are based largely on pollutor pays principle

Soil And Water Conservation

It is estimated that out of 22.4 lakh ha of cultivated land in the state, around 9 lakh ha. is prone to soil erosion. The conservation measures will be effective only if they are organised on a watershed basis. In view of the predominance of relatively small sized holdings, massive interventions on a contiguous area basis are essential with the support of local bodies. Among the major crops, plantation crops - particularly rubber are planted after proper soil conservation and land development. On the other hand, perennial crops such as coconut, pepper and cashew are planted without providing the required land preparations. Soil and moisture conservation is critically important for crops like pepper which are normally raised in the upper elevations of the land terrain. The undulating topography with alternating hills and valleys, the high intensity of rainfall spread over two monsoons, low infiltration rate of soil and denudation of forests have accentuated the problem of soil erosion in the State.

6.83 With the substantial assistance rendered by NABARD under RIDF and the inclusion of a good number of projects as part of local plans, soil and water Conservation activities in the watersheds of the State received an impetus during Ninth Five Year Plan. The cumulative coverage under soil conservation at the end of Ninth Five Year Plan was 2.40 lakh ha. The achievement of soil and water conservation programmes during 2002-03 is given in Table 6.7.

Table 6.7
Achievement of Soil and Water Conservation Programmes during 2002-03

Name of Scheme	Achievement	
	Financial (Rs. lakhs)	Physical (ha.)
State Plan		
i) RIDF	960.82	4824
ii) Other State Plan schemes	51.44	372
Centrally Sponsored Scheme		
i) NWDPPRA	6.61	
ii) River valley project – Kabini	215.87	520
Total:	1234.74	5716

6.84 The projects under RIDF I and RIDF II were completed in December 1997 and in December 1999 respectively. Under RIDF I, 37 watersheds in the five districts of Thiruvananthapuram, Idukki, Wayanad, Kannur and Kasaragod was completed with a total project cost of Rs.10.13 crore benefiting an area of 5718

ha. Phase II of the programme comprised of 26 watersheds with a project cost of Rs.12.93 crore benefiting an area of 7859 ha in 9 districts and under RIDF III 37 watersheds were completed in 14 districts having a total project cost of Rs. 2161.50 lakhs and benefitted an area of 10,890 ha. by expending an amount of Rs.1845.07 lakhs. Projects in phase VI, VII and VIII are in progress. During the period under review 4824 ha was benefited with an expenditure of Rs.958.57 lakhs. Details of RIDF projects are given in Table 6.8.

6.85 An evaluation study of the completed soil conservation schemes in nine districts of Kerala under RIDF II was done by Agricultural Finance Corporation Limited. (AFC) during 2003.

6.86 The National Watershed Development Project for Rainfed Areas (NWDPA) is a Centrally Sponsored Scheme taken up from 1990-91 onwards. During Eighth Plan, an area of 88,226 ha. coming under 114 watersheds received the benefits of the scheme with an expenditure of Rs.29.94 crore. During Ninth Plan the project was implemented in 74456 ha. coming under 114 watersheds lying adjacent to the old ones, expending an amount of Rs.25.69 crore. Government of India has revised the guidelines for implementation during Tenth Plan. As per the revised guideline 30 sub watersheds have been identified in the State with an effective project area of 72032 ha. The District Watershed Committee and Water Shed Development Team were constituted and Project Implementing agencies and Nodal Agencies were identified in all districts. During 2002-03 an amount of Rs.6.61 lakhs has been expended.

6.87 River valley project - Kabini is a centrally sponsored inter state scheme of Kerala and Karnataka started in the year 1998 being implemented in the catchment of Kabini river (Kerala portion) which originates from Kerala State. The major portion of the catchments of Kabini (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. Total catchment area of Kabini is 1.635 lakh ha of which 1.05 lakh ha requires soil and water conservation measures. An amount of Rs.549.00 lakh has been spent upto 3/2003 for covering an area of 2470 ha which includes an expenditure of Rs.215.87 lakhs during 2002-03 for covering an area of 520 ha. The implementation of the project will benefit substantial area of Wayanad district including land owned by Scheduled Tribe (13%) and Scheduled Caste families (4%). However the progress of the project is quite slow

6.88 Watershed based interventions has a direct effect on soil moisture recharge. Critical in the development of watershed is the adoption of appropriate technologies suited to different agro ecological and socio economic situations to realize the anticipated benefits.

6.89 Many states have taken up development of degraded areas under the watershed approach on a mission mode. A paradigm shift in the approach to watershed development came in 1995-96 with the adoption of revised guidelines in line with the Technical committee report headed by Dr. C.H. Hanumantha Rao . The new paradigm of "watershed plus" recognises the need to involve the community as a necessary condi-

Table 6.8
RIDF Assisted Soil and Water Conservation Programmes

RIDF Phase	Period	No. of Watershed			Project cost (Rs. lakhs)	Project Area (Ha)	Cumulative Achievement	
		Sanct ioned	drop ped	Completed /ongoing			Physical (Ha)	Financial (Rs. lakhs)
RIDF I	1995-97	40	3	37	1013.20	5902	5718	996.09
RIDF II	1996-99	32	6	26	1292.99	8725	7859	1087.45
RIDF III	1998-02	40	3	37	2161.50	13423	10890	1845.07
RIDF VI	2000-03	20	-	20	1021.87	6220	3663.21	739.28
RIDF VII	2002-04	40	-	40	1779.32	13694	5216.45	796.62
RIDF VIII	2002-05	12	-	12	647.40	5175	700.5	130.7

Box -6.11**Major Findings and Recommendations of the Evaluation Study of 9 watershed projects under RIDF. II**

- The average per hect. expenditure for the nine watersheds was Rs.17,552, ranging from Rs.7,727/- to Rs.27,146/-
- Out of the total expenditure incurred on various interventions, 95.2 per cent was for engineering/ structural measures of soil conservation, whereas the expenditure for Agronomic, Agrostologic and Farm-forestry measures was only 4.8 per cent. Out of 95.2 per cent expenditure incurred on Structural Measures, 87.6 per cent was for three interventions viz. Stone Pitched Contour Bunds (62.7%), Retaining Walls (14.4%) and Loose boulder Checkdams (10.5%). All these structural measures were costly items and the low cost engineering measures were adopted only to a limited extent of 7.6 per cent.
- Soil conservation schemes were prepared without investigation. The schemes prepared were lacking in the required benchmark details. Frequent revisions of the original estimate have been necessitated as a consequence of this. The scheme reports were not supported with the required land use maps and proposed management plans.
- Recommendations
- PRA should be conducted in the proposed watershed.
- More emphasis should be given for low-cost technologies by providing at least 20 per cent amount from the total provision for all such items put together.
- The beneficiary committee may be constituted only after giving wide publicity for launching the scheme for ensuring people's participation.
- The beneficiary committees should meet regularly. Transparency has to be maintained in the aspects such as benefits received from the soil conservation unit, admissible wage rates for labourers and the technical parameters. Designs for situation specific check dams may be evolved, avoiding the excessive dependence on type designs.
- More emphasis should be given for water harvesting structures,
- The beneficiaries themselves are to be motivated to conduct timely repairs of the damaged works. Two per cent of the project cost may be earmarked for maintenance and follow up. Raising a corpus fund for the above purpose may also be considered so that the Panchayat can attend to this work, especially in the community land/public land.
- More effective linkage between Soil Conservation and Soil Survey wings at District level is required in order to facilitate preparation of technically sound schemes for land development.

Source: Agricultural Finance Corporation Evaluation Report 2003

tion for the sustainability of watershed programmes. The programme seeks to ensure convergence of all other programmes that promote economic activities and generate increased employment opportunities. Conscious efforts to promote non farm employment and increased land access for the land less as well as promotion of self help groups form a part of the new approach.

6.90 The involvement of PRIs and local People in Planning and implementation of Watershed Programmes determines to a great extent the success of the programmes. A common approach in tune with the

guidelines issued for implementation of Watershed Programmes through decentralised planning needs to be adopted for all Watershed Programmes implemented in the State. The success hinges on the extent of securing the participation of the local community to take care of resource management.

Western Ghats Development Programme

6.91 The Western Ghats Region of Kerala comprises of 31 taluks covering around 72 per cent of the geographical area and around 50 per cent 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 per cent of the geographical area of the region.

6.92 The Western Ghats Development Programme which originated during 1974-75 as part of the Hill Area Development Programme with special central assistance is being operated as an integral part of the State Plan from the Ninth Plan but fully financed by Government of India. This programme aims at the ecological and economic improvement of the area and living conditions of the local people. As a part of Tenth Five Year Plan strategy, detailed guidelines were formulated to integrate WGDP with the decentralised planning process. The sectoral plans under this programme are to be designed based on a sub plan approach aiming at the integrated development of the region on a watershed basis. The strength and weakness of watershed programmes implemented by WGDP in earlier years were revealed in a recent study. The findings of the study are shown in BOX 6.12:

6.93 In planning any watershed development programme, community participation is indispensable and farmers should be closely involved in the planning and implementation of the programmes. In several programmes though funds are allocated based on entire area the effective treated area in watershed is very low due to lack of proper plan, supervision and monitoring. In Madhya Pradesh the encouraging performance in some of the watershed programmes is attributable largely to the higher rate of people's participation implemented through the decentralised framework. The Panchayat Raj Institutions are given a major role in the revised guidelines of WGDP, for the implementation of watershed programmes in Kerala which may enhance effectiveness of the programmes implemented in the state.

6.94 The major schemes implemented under WGDP include forestry, village and small scale industries, horticulture, soil conservation, minor irrigation, dairy development, agriculture etc. The expenditure during the Ninth plan was Rs. 6112.70 lakhs of which 21 per cent was for Soil Conservation, 23 percent for Forestry schemes and 18 percent for Minor Irrigation works. The physical achievement during the period consists of Soil Conservation works in 9941 ha, fodder development in 1215 ha and construction of 3764 cattle sheds and 2216 wells. During 2002-03 Rs.13.13 crores has

been spent and out of this Rs.7.5 crores is utilized for 41 watersheds in the state.

Box -6.12

Major Findings/Recommendations of the Evaluation Study of WGDP Activities During VIII and IX Plan Period.

- Subsidy for wells for agricultural purpose was often misused and watershed committee should identify the beneficiary having the requirement of irrigation and desired plot size.
- The items of work should be depending on the specifics of the watershed/districts and considering the occupational characteristics of the inhabitants. Activities such as compost pit subsidy, nurseries and kitchen garden should have been avoided.
- While selecting the beneficiaries of Animal Husbandry schemes, cattle rearing history needs to be considered.
- Soil conservation work in the forest areas could have been avoided.
- Vegetative cover protection could have been considered for slope stabilisation.
- Soil conservation works were done mostly in private properties.
- Utilised public funds for side wall construction of private property
- Better norms need to be evolved for identification of beneficiaries.
- Agrostological measures in soil conservation may be encouraged linked with the agricultural, dairy and other income generating programmes.
- Monitoring of the programme should be done by a team comprising members of local bodies, officials and representatives of active NGO's operating in the watershed
- The objective such as eco-development and eco-conservation have been met only partly.
- Role of watershed committees must be strengthened and shall be responsible for selection of beneficiaries.
- NGO's are ill suited to undertake soil conservation work.
- Need awareness about the implication of ecological degradation at local level.

Forestry and Wild Life

The National Forest Policy 1988 aims at 33 per cent of country's geographical area under forest and tree cover and envisages maintenance of environmental stability through preservation and reduction of degradation of forests, conservation of bio-diversity, increasing the productivity of forests, increasing substantially the forest cover through massive afforestation and developing participatory forest management. The present management policy of the state encompasses technology improvement, bio-diversity conservation and development of partnership with the forest dependent communities.

6.96 Kerala ranks 14th among all the States/Union Territories in respect of percentage of geographical area under forest cover. Madhya Pradesh with 77265 sq.km. has the maximum area under forest cover followed by Arunachal Pradesh (68045 Sq.km.) and Chattisgarh (56448 sq.km.) (Table 6. 9).

6.97 Forest cover of Kerala is largely spread over the Western Ghats of the state. The Western Ghats represent one of the world's 18 hot spots of bio-diversity and is considered to be a repository of rare and endangered flora and fauna. The forest area in Kerala is 11263.88 sq. km. (28.94% of geographical area which is higher than the national average of 19.50%) which included 9284.86 sq. km. reserve forest, 1837.45 sq.km vested

forests and 141.57 sq. km. proposed reserve. . The percentage of forest cover in Kerala to that of India is 1.5 per cent. Out of the total of 11263.88 sq. km. of forest area, effective forest area in Kerala is only 9400 sq. km. as given in Table 6.10.

6.98 As per the assessment of Forest Survey of India (2001), the area under forest in the state is 11221 sq.km. which is higher than the effective forest cover as assessed by KFD. Division wise details of forest cover is given in Appendix: 6.10

6.99 The forest cover in the country according to 1999 assessment was 637293 sq.km. while the 2001 assessment showed an increase of 6 per cent. Among the states highest net increase of 5237 sq. km. was observed in Kerala. Forest cover assessed in 2001 consists of all lands with more than 1 ha having tree canopy density of more than 10 per cent interpreted from satellite data, irrespective of tree species. Eventhough higher tree cover were reported in 2001, direct comparison with 1999 assessment would be invalid since 1:50000 scale digital interpretation was adopted in 2001 while 1: 250,000 visual interpretation in 1999. Technical factors as well as changes in the ground have contributed to the changes.

6.100 The forest cover of the state as per the 2001 assessment of FSI was 15560 sq.km. (dense forest 11772

Table 6.9:
Forest Cover in Various States in 2001

(in Sq.Km)

State	Recorded Forest Areas		Forest cover 1999		Forest cover 2001		
	Dense	Open	Open	Total	Dense	Others	Total
Andhra Pradesh	63814 (23.20)	24587	19642	44229	25827	18810	44637
Arunachal Pradesh	51540 (61.55%)	57756	11091	68847	53932	14113	68045
Karnataka	38724 (20.15)	24835	7632	32467	26156	10835	36991
Kerala	11221 (28.87)	8429	1894	10323	11772	3788	15560
Madhya Pradesh	95221 (30.89)	42062	33075	75137	44384	32881	77265
Maharashtra	61939 (20.13)	26721	19951	46672	30894	16588	47482
Orissa	58135 (37.34)	26288	20745	47033	27972	20866	48838
Chattisgarh	59285 (43.85)	39557	17137	56693	37880	18568	56448
Tamil Nadu	22871 (17.59)	8680	8398	17078	12499	8983	21482
India	768436	382229	355064	637293	416809	255729	675538

Source : Forest Survey of India- 2002

Figures in Parenthesis indicate per cent to geographical area

Table 6.10:
Types of Forest in Kerala

Sl. No.	Forest Type	Area (Sq.km.)	% of Total area
1	Tropical Wet Evergreen and semi evergreen Forests	3299	35.10
2	Tropical Moist Deciduous Forests	4100	43.62
3	Tropical Dry Deciduous Forests	100	1.06
4	Mountain Sub Tropical Temperate shoals	70	0.74
5	Plantation	1810	19.26
6	Grass land	21	0.22
	Total	9400	100

Source : Department of Forest

sq.km. and open forest 3788 sq.km). Forest cover includes all lands more than one hectare with a tree canopy density of more than 10 per cent including non-forest area. Certain areas with tree canopy such as coconut, orchards, coffee and tea estates have been included in the assessment, and the forest cover constitute 40 per cent of states geographical area.

6.101 The nature of forest in Kerala shows wide variation among the categories ranging from tropical wet evergreen to tropical dry deciduous forests. The area under different types of forest is shown in Table 6. 10. Tropical evergreen and tropical moist deciduous forests accounts for 79 per cent. The coverage of the plantation forestry is to the extent of 19 per cent.

6.102 Out of total area, 1.88 lakh ha. is degraded with crown density below 40 per cent. Afforestation of the degraded forests is one of the thrust areas for forestry development, supported under various programmes which include compensatory afforestation, general forestry and World Bank aided Kerala Forestry Project. Afforestation of degraded forests has been carried out in 8719 ha. under various programmes up to 2002-03.

6.103 Forest plantation constitutes the major source of raw materials to the forest based industries. The total area covered by forest plantation of various species is about 1.81 lakh ha., which has remained more or less stagnant during the last three years. Teak is the major species planted (41.52 %) followed by mixed plantation (31.57%) and Eucalyptus (12.41 %) (See Appendix 6.1)

6.104 Major forest produce includes timber, reeds, Bamboo and firewood. Their total production shows a declining trend from 1993-94 onwards. Reeds and bamboos show sharp decline in supplies during the period while the extraction of timber is own the increase. The quantity of timber produced in 2001-02 was 38915 cum. The number of bamboos and reeds produced was 339.16 lakhs. These are species which can be promoted under farm forestry with peoples participation. The trend in production of forest produces during the last eight years is shown in Appendix 6.12

Agro Forestry

6.105 Indian forest productivity at 0.7 m³ of wood per year per hectare is one of the world's lowest. There is a growing demand supply gap and agro forestry assumes significance in this regard. The home gardens is a basic agro ecosystem in Kerala. A wide spectrum of trees and shrubs, more than 127 species, are reported in the Kerala home gardens. Most of these species are under exploited. Available micro level studies indicate that standing stock of commercial timber from the Kerala homesteads is between 6.6 and 50.8 m³ per hectare. Bio diversity of Kerala home gardens has declined drastically due to commercialization. In order to conserve and improve on-farm genetic diversity and to enhance timer productivity from the traditional land use systems, concerted efforts are necessary especially for evolving technology packages on tree management and production and distribution of quality planting materials. The provisions in the Kerala preservation of Trees Act 1986 impose restriction on harvesting of ten species from the private fields. Based on the pro-

posal of the Law reforms committee, a new bill on promotion of Tree growth in Private lands has been prepared for facilitating tree growth in Private lands.

6.106 The National Forestry Action Plan projects the annual requirement of timber for household sector in the country at 66.6 million cubic meters (cum) in the year 2006 and the total timber requirement at 81.8 million cubic meters. Against the demand, production from forests has been estimated at 29 million m³ in 2006.

6.107 Farm forestry does not adequately figure in the local plans of the panchayats. Dearth of adequate planting materials of the desired species is a major constraint for popularising the activity in rural areas. District and Block Panchayats can render the required support for organising nurseries with people's participation. Planting of trees in homesteads and public places could be promoted by the grama panchayats by involving farmers and NGOs.

Participatory Forest Management (PFM)

6.108 Joint Forest Management was introduced in India with the proclamation of National Forest Policy 1988. However, through a resolution in 1990, the scheme was actually introduced in all the states in India. Under the scheme, the forest dependant communities are given rights to collect lops and of branches, non-timber forest produces etc. The Kerala Forest Department has taken initiative and lead role in calling for people's participation in forest management and Participatory Forest Management was implemented.

6.109 The Kerala Forest Department started PFM in selected villages along the forest fringes and within the reserves as a part of Kerala Forestry Project. It is only in the initial stages. In order to assess the strength and weakness as well as to identify the conditions for successful implementation of PFM, an evaluation study was conducted. The major findings of the study are shown in Box 6.13

6.110 Forest officials need re-training for working with people. There is need for much wider spread of the VSS across the forest areas in the State.

Forest Development Agencies (FDAs)

6.111 FDA was constituted in the state in 2002-03 with a view to guide the activities of VSSs. 33 FDAs have

Box -6.13

Major Findings of the Study on PFM in Kerala

- Awareness about the concepts and objectives of PFM is inadequate at all levels
- People have begun to feel sense of belonging to VSS in places where the Forest Department has been interacting with commitment.
- The time has not been sufficient even to re-orient the people to the participatory mode.
- Most of the Microplans need to be revisited using the prescribed microplanning format and procedures.
- VSS is picking up well in certain areas where people have awareness and institutional backing.
- All tribal VSSs find it difficult to market NWFP
- Almost all VSSs suffer from delay in getting approval and money.
- Wherever VSS is a big success vested interests from outside have started intervening through party politics.
- VSS has proved to be very effective in protection and conservation.
- All VSS implementing areas have witnessed good regeneration of forests.
- The infrastructural and personal capacity of KFD is far more than what is needed for successfully implementing PFM in the State.
- It is essential bring about co-ordination among the State Departments (concerned) as well as the VSSs.
- It is necessary to have more prudent delegation of responsibilities among the Department staff and the VSS executive committee members.
- It is necessary to include enough representation of the weaker sections and women in committees, sub committees, etc.

been constituted as on 31.3.2003. MoEF will release funds directly to FDAs. Government of India have sanctioned Rs.105.50 lakhs for 6 FDAs during 2002-03 and another Rs.149.00 lakhs for 4 more FDAs during 2003-04. The amount will be utilised for artificial regeneration, bamboo and cane plantations, medicinal

plants, and regeneration of perennial shrubs of medicinal value, pasture development etc. The total amount allocated to the above 10 FDAs from 2002-03 to 2006-07 comes to Rs. 32.77 crores.

Forest Revenue

6.112 The revenue from the forestry sector by way of sale of timber and other products comes to Rs. 149.57 crores in 2002-03 as against Rs.113.7 crores in 2001-02. The State Government have modified the policy of supplying raw-materials to M/S .Hindustan New Print Limited and to M/S. Grassim Industries Limited at reduced rates, there will be an annual increase in the price of forest produce supplied to them at 20% per annum. The increase in revenue attainable through this measure is of the order of Rs.10 crores per annum. The changes in forest revenue for the last five years is shown in Appendix 6.13

Wild life and Biosphere Reserve

6.113 The two National Parks, 12 Wildlife Sanctuaries and one Biosphere Reserve coming under the category of protected areas in Kerala cover an area of 2395.4 sq.km.lakh ha. which is 21% of the total forest area and 6 % of the total geographical area. This is higher than the national coverage of 5% Details are

given in Table 6.11 Protected area are managed now as showcases of bio diversity with predominance for large animals in habitat management, Participatory Management based on the principles of eco-development has been initiated and this strategy has attracted co-operation of the neighborhood communities and forest dependent communities.

6.114 Biosphere Reserves are terrestrial and coastal ecosystems which are internationally recognised within the framework of UNESCO's Man and Biosphere programme. In the country, 13 Reserves have been set up and in 2001, UNESCO approved designating the Sunderban (West Bengal) and Gulf of Mannar Reserves. As a result three Biosphere Reserves from India are now included in the World Net Work, the third being Nilgiri (Kerala, Karnataka and Tamil Nadu) which was designated earlier. Agasthyamala Hills in Kerala comprising area of 1701 sq.km. has been designated as 13th Biosphere Reserve in 2001. Detailed action plan and focussed cultivation will facilitate attraction of additional funding for these sites for long term conservation and sustainable utilisation of resources.

6.115 The first National Wildlife Action Plan of 1983

Table 6.11
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	2,395.40	
15	Nilgiri Biosphere Reserve	1,455.40	1986
16	Agasthyavanam Biological Park	30.00	1992

Source : Department of Forest

has been revised and the new wild life Action Plan (2002-2016) has been adopted at national level. The plan outlines the strategies, action points and priority projects for conservation of wild fauna and flora in the country. A systematic management of PAs is almost important from ecological, environmental and socio economic point of view. Detailed plan has to be prepared for the implementation of Management Action Plans prepared under the Kerala forestry Project.

General Forestry

6.116 During 2002-03, an outlay of Rs.19.00 crores was provided to the forestry and Wildlife sub sector and an amount of Rs.14.69 crores (77%) was expended. The various schemes implemented during the period include management of natural forests with an expenditure of Rs. 3.88 crores, improving productivity of plantations with Rs. 1.47 crores, strengthening of infrastructure facilities with Rs.1.70 crores, strengthening biodiversity conservation and management of protected area with Rs. 5.14 crores. The scheme on Management of Non-Wood Forest Produce was started during 2002-03 with an expenditure of Rs.0.55 crores. The World Bank aided Kerala Forestry Project was started in 1998 and cumulative expenditure up to 03/2003 was Rs.132.49 crores.

6.117 Under General Forestry, survey and demarcation of forest boundaries is one of the important activities taken up. Out of an estimated boundary of 11220 kms, 2193 kms were demarcated during Ninth Plan. The activities for boundary protection during 2002-03 include survey of forest boundaries covering 4617 cairns and reconstruction of 28 cairns. Fire protection is another important work done during 2002-03. The coverage under this activity during this period include fire line (939 kms), protection of forests (2000 ha.) etc. The cultural operations include special tending (103 ha.) and climber cutting (70ha.) Other activities are maintenance of roads (68.km.) construction of buildings (7 nos.), maintenance of buildings (16 nos.) maintenance of industrial plantations (292 ha.) replantation of industrial plantations (86 ha.) etc. Maintenance of fuel wood and fodder plantions (765 ha.) raising fuel wood and fodder plantions (180 ha.) etc.

Management of Non-Wood Forest Produce

6.118 The NWFPs including medicinal plants is being given a major thrust because of their importance around the world. The main objectives are conservation and

improvement of the NWFPs including medicinal plants, increasing the production and replenishing the stock of NWFPs and medicinal plants and providing additional income to the tribal and the rural poor living in and around forests. The productivity and management of NWFPs are to be improved through sustainable and scientific management by adopting improved methods of harvesting processing, value addition and marketing.

6.119 The DANIDA assisted programme of Medicinal Plants Conservation and strengthening the medicinal plants resources in the southern states of Kerala, Karnataka, Tamil Nadu and Andhra Pradesh was started during 1993 through the NGO, Foundation for Revitalization of Local Health Traditions, Bangalore. In Kerala nine MPCAs for in situ conservation of medicinal plants were established. Also four MPCAs in Kerala were maintained by TBGRI, Peerumedu Development Society, Centre for Indian Medicinal Heritage and Wayanad Social Service Society. Out of the 100 RET plants available in South India, 76 plants are being protected and propagated in the MPCA network.

6.120 In addition to the protection and conservation measures taken by the department, these activities should be strengthened by executing the same through actual consumer groups themselves. For this purpose VSS were formed. The collection of NWFPs is entrusted with these user groups and they undertake collection.

6.121 During the year 2002-03, Rs. 50 lakhs have been earmarked for management of medicinal plants and it was raised to Rs. 110 lakhs during 2003-04. In addition to State Plan support, some specific projects are being supported by the national Medicinal Plants Board.

6.122 In order to meet the growing demand of Plant based medicines in the national and international market, it is essential to grow medicinal plants in degraded forests also. During Tenth Plan, it is proposed to establish 200 Vanaspati vans over 1 million ha. of degraded forests in the country. Eventhough Kerala has prepared a project few years back, funding could not be mobilised.

Compensatory Afforestation Scheme

6.123 The Compensatory afforestation project was sanctioned at an estimated cost of Rs.113.00 crores to be implemented within a period of 10 years starting

from 1993-94. The objective of the scheme is the afforestation of 57,176 ha. of forestland in lieu of 28588 ha. lost by way of encroachment prior to 01.01.1977 which is a pre-condition for obtaining Government of India clearance for issuing patta to the encroached land.

6.124 Seedlings of various species were distributed to various NGOs during 2002-03 for tree planting in the premises of schools, colleges and also along the sides of National Highways and State Highways with active participation of the Departments of Education, PWD, Grama Panchayats, Avenues and to plant trees. During the year 5,04,648 numbers of seedlings have been distributed for planting.

Kerala Forest Development Corporation

6.125 KFDC is a public sector undertaking with shares owned by Government of India and Government of Kerala. The area of the corporation is located in Forest areas situated in 7 revenue districts and 10 territorial forests. The total area of 10717 ha. (8006.86 ha of tree plantations and 2710.13ha. under cash crop) is under 9 divisions and 26 sub units and it cultivated trees like Eucalyptus, Acacia, Teak, Albizia, Manjium etc. and cash crops like Cardamom, Coffee, Tea, Pepper etc. The corporation has an authorised share capital of Rs. 0.00 crores, of which paid up share capital is Rs. 7.78 crores.

6.126 The activities undertaken during 2002-03 include plantation in 529 ha. with plywood species (Eucalyptus, Acacia, Manjium etc.) under Participatory Plantation Protection Scheme utilising Rs.158.25 lakhs. Eco-Tourism activities being carried out at Gavi and Munnar were extended to two more divisions viz., Trivandrum and Nenmara during this period. KFDC entered into an agreement with M/s. Hindustan Newsprint Limited for the supply of 25500 MT of pulpwood during 2002-03 at subsidised rates and supplied 13683 MT against the above allotment. The KFDC undertook the work of avenue planting along the sides of Kazhakootam-Kovalam bye-pass during 2000-01 on contract basis for an amount of Rs.11.78 lakhs/- and the plants were maintained during 2002-03 also. The KFDC had entrusted the task of nurturing and harvesting of Cardamom from evicted Cardamom area at Mathikettan in Idukki district and 50000 kg. of green Cardamom was collected which fetched Rs.35.00 lakhs. During 2002-03, a profit of Rs.87.50 lakhs whereas the profit during 2001-02 was Rs.117.00 lakhs.

World Bank Aided Kerala Forestry Project

6.127 The World Bank aided is under implementation

from 1998 and has been extended till December 2003. The original project cost was Rs. 182,39 crores. During 2001, mid term review of the project was undertaken by the World Bank and outlay was revised to Rs. 166 crores. The cumulative expenditure upto the end of October 2003 was Rs. 145.36 crores. In project has three components; viz., strengthening sector management, strengthening forest management and biodiversity conservation. During 2002-03, 359 fire protection committees in 32 divisions were constituted for carrying out the fire management activities. An extent of 114321 ha. has been protected from annual fire hazards by the Fire Protection Committees. The important achievements include assisted natural regeneration (22890 ha), rehabilitation of degraded forests (14104 ha), regeneration of Teak and Bamboo (6799 ha), raising Teak plantation (2214 ha), pulpwood plantation (4310 ha). Participatory Forest Management (356 VSS have been registered and 94665 ha. of area covered). Details are given in Appendix 6. 14- 6.16 As part of the project, Biodiversity Action Plan has been prepared. The Forest Management Information System with 15 modules were developed during the project period.

Haritholsavam (Greening the State Programme)

6.128 A project for massive tree planting under the name Haritholsavam was commenced from 9th August 2002, planting various species of seedlings along the sides of National and State High ways and other public places; with the active participation of National Services scheme volunteers and other NGOs. It was decided to plant 15 lakhs of seedlings on the same day and the target achieved was 13,21,178 nos. However the post planting care was quite weak and the survival rates are reportedly low. This scheme has to be implemented in a participatory mode with the involvement of local governments.

Greening India for Livelihood and Sustainable Development

6.129 Greening India programme has been founded on the premise that no strategy to conserve the forest ecosystem would be successful, unless the needs of the least advantaged and most vulnerable sections of the society are met. The cost of environmental degradation is mostly borne by the poor. Poverty and environmental crisis are closely linked, calling a holistic approach and lasting solutions through greening of all degraded areas with people participation. The 10th Five year plan has set a monitorable target to increase forest/tree cover to the extent of 25% by 2007 and 33% by 2012. The programme proposes to cover 43 million

ha degraded land under forest, in a 10 year period by regenerating 15 mha degraded forests under JFM and by bringing 10 mha of irrigated land under commercial agroforestry and 18 mha of rainfed area under subsistence agroforestry. It also aims at reversing the current trend of spending more than Rs.8000 crores per annum on the total import of forest produce

6.130 In order to formulate a comprehensive strategy and action plan for 10 years, for greening the country, ensuring conservation of all natural resources besides improving ecology, economy and generation of productive employment and ensuring food accessibility to 100 million people, the planning commission, GOI constituted a Task Force with Dr. D.N.Thiwari, Member of the Planning Commission as its Chairman. The critical strategy requirements identified by the team were the following.

1. To maintain existing forest through conservation and management, sustain and expand areas under forest/trees through rehabilitation, regeneration, afforestation, reforestation and tree planting
2. To carry out re-vegetation in appropriate mountain areas, islands, barren lands arid/semiarid lands and coastal areas through JFM.
3. To promote Agroforestry for increasing tree cover and to improve sustainable agriculture.
4. To promote and support the downstream processing of forest products to increase retained value and other benefits.
5. To establish linkages between producers and forest based industries for improving economy and generation of employment.

The salient features of the report of the task force are given in Box 6.14.

Environmental Sanitation

Background

The history of rural sanitation in India began in earnest with the movement for liberation of scavengers, which was an integral part of the freedom movement. In 1954 a sanitation component was introduced in the Health Sector of the Government of India. The first organized attempt made in Kerala was the pilot project sponsored by the WHO in Thiruvananthapuram in the fifties. From the late fifties onwards single leach pit latrine with a squatting slab and water seal bowl placed directly over the pit was vigorously propagated

by the NES Blocks. This found favour in the rural areas and came to be known as ESP type latrines. The period from late sixties to early eighties showed a declining trend in sanitation activities, primarily due to the gradual decrease in extension work in rural areas. International Water Supply and Sanitation Decade Programme which was launched in 1981 generated a lot of discussions about the future directions of the sector.

6.132 Rural Sanitation got a fillip in 1986 when construction of individual household latrines was brought under NREP and RLEGP and later under JRY and IAY. An exclusive programme for sanitation, namely, Central Rural Sanitation Programme (CRSP) was launched by Government of India in 1986 with the objective of improving the quality of life in rural areas and to provide privacy and dignity to women. As sanitation is a State subject, CRSP sought to supplement the efforts of the States in covering rural population with sanitation facilities. Rural sanitation was included as part of Minimum Needs Programme as well from the year 1987-88. The revised guidelines of CRSP issued in 1993 put forward an integrated approach which advocated construction of household latrines, soak pits, garbage pits, bathing and washing platforms, kitchen sanitation, smokeless choola and biogas. However access to latrine in households was continued to be seen as the basic indicator of sanitation.

6.133 The first Model Village Sanitation Project (MVSP) under CRSP was sanctioned in Pallipad Grama Panchayat in 1994. The Model Village Sanitation Programme which had a strong hygiene education component was the first step towards viewing sanitation in its broader perspective.

Towards a definition

6.134 The following elements define the package of practices which together constitute sanitation.

- (i) Safe disposal of human excreta;
- (ii) Solid waste management;
- (iii) Liquid waste management;
- (iv) Safe handling of drinking water;
- (v) Home sanitation and food hygiene;
- (vi) Personal hygiene; and
- (vii) Community environmental sanitation

6.135 These are universally accepted as the **seven components** of sanitation. Therefore sanitation refers

Report of the Task force on 'Greening India' for livelihood security and sustainable development

Strategy for JFM

- Suitable forest patches to be entrusted to well defined user groups with transparent **mou** ,with security of tenure and long access of benefits.
- Legal back up to JFM committees and "Food for work ' schemes to be launched to ensure food accessibility for JFM members.
- Appropriate institutional and financial mechanisms and tie-up of village protection committees with industries.
- Detailed projects to be prepared for assistance under RIDF of NABARD.
- To set up Forest Development Agencies as Federation of JFM committees.

Strategy for Agroforestry

- Commercial Agroforestry to be practiced in irrigated land with suitable species of Acacia, Bamboo, Cassurania, Eucalyptus, Populus and Prosopis.
- Agroforestry to be tried in rainfed areas, complementary and supplementary to agriculture, by adopting various models on watershed basis, to cover 18 mha, on an annual basis of 1.8 mha.
- To establish high-tech modern nurseries on catchment basis and to develop elite clones of important agroforestry species, with the participation of corporate/private sectors in R&D.
- To evolve product research, product development, new design and quality standards for down stream processing.
- To develop Market Information System and establish Agroforestry Boards and Marketing Federations to improve the bargaining power of ,farmers in domestic and export markets.
- To amend all the existing laws and executive orders related to felling, transport, processing and sale, to facilitate Agroforestry.
- To start Bamboo Technology Mission.
- To expand the NABARD investment on the schemes for Farm/Agroforestry, to the tune of Rs.1000 crores per year.

Research and Development

- To carry out research and technology development efforts to
- Protect existing forest/trees from fires, diseases etc.
- Increase productivity and forest density by promoting regeneration, enrichment plantation, rehabilitation, afforestation, soil and water conservation ,with people' s participation.
- Selection of high yielding and disease resistant clones for different edaphic and climatic conditions.
- Use of bio-fertilizers and bio-pesticides for boosting production and control of pests and diseases.
- Develop new generation products of bamboo composites and laminations for exports

Institutional Mechanism

- To co-ordinate , monitor and evaluate various activities such as JFM/Agroforestry, Social forestry and other plantation schemes being implemented by several departments of central and state governments, a Green India Authority is to be set up in the planning commission . The authority will also operate the " Green India Fund " to be created.
- 2 separate Departments ,ie. Department of Forest and Department of Environment should be created in the Ministry of Environment and Forest; and the National Afforestation and Eco development Board should be abolished , with its schemes transferred to the proposed Forest Department.
- The National Research Centre for Agroforestry, Jhansi, and Centre for Social Forestry and Eco-Rehabilitation, Allahabad to be upgraded to National Institutes.
- Forest Research Institute, Dehradun and Institute of Wood science and Technology, Bangalore should carry out forest product research on priority basis and promote quality standards designs of new products.
- Indian Plywood Research and Training Institute (IPIRTI) Bangalore, should concentrate on development of next generation products of Bamboo composites.
- Indian Institute of Forest Management, Bhopal, and Indian Council of Forestry Research and Education, Dehradun should carry out socio-economic and marketing research.
- Department of Bio-technology should identify elite clones of agroforestry species and standardise their macro and micro propagation techniques.
- A separate cell of Agroforestry/ JFM should be created in NABARD.
- 100 NGOs ,,possessing land and other infra structure facilities should be identified for mass production of seedlings and for extension activities.

Source: Planning Commission, GOI, 2001

to the entire range of habits and practices in daily life that helps a healthy life and through that contributes significantly to the well – being of the community. Sanitation can be defined as “the science and practice of effecting healthful and hygienic conditions”.

Safe Disposal of Human Excreta

6.136 The direct environmental health risk associated with open defecation is very high. The most important intervention is to contain the problem by enabling those practicing indiscriminate defecation to have sanitary latrines through strong promotional activities.

Present Status

6.137 Not only the rural areas, but also the cities and towns of Kerala were known for their cleanliness. The people of the State are also known for their clean and hygienic latrines. Environmental cleanliness has suffered a great deal in the last two decades.

6.138 Kerala has the highest coverage of individual household latrines in India. However coverage is lower in households below poverty line and other sanitation conditions such as solid and liquid waste disposal, drainage, and community sanitation are very poor. This situation is a burden particularly on the women. The percentage of households with access to sanitation facilities according to different estimates is given in Table-6.12. According to 2001 Census the total coverage of households in the State with latrines is 84%. That is, out of the 65.95 lakh households in the State 55.40 lakhs have sanitary latrine facilities. Though the urban coverage (92%) is higher than the coverage

for rural areas (81.3%), the decadal rate of coverage is higher in the latter case. In absolute numbers 9.93 lakh households in the rural areas and 1.32 lakh households in the urban areas still do not have individual household sanitary latrine. There is a possibility that the present data on households with sanitary latrines may include those households with the type of latrines which are unhygienic and unacceptable on health grounds. For example, on the banks of West coast canal and in Kuttanad, there are canal latrines with no substructure to prevent excreta from falling in to water. Thus a re-look at the present data on household latrines in the State is necessary. It is possible that the number of households having safe latrines is less than the reported figure of 55.50 lakhs.

Community Perceptions

6.139 The baseline survey for the formulation of the Netherlands Assisted Programme (NAP ii) done in three districts established that the priority service need of the people is for improved water supply with household sanitation coming next.(Table 6.14).

6.140 The NAP Report also shows that for household sanitation, latrines are the priority preference with bathing places and household wastewater drainage following. The Development Reports of the Grama Panchayats, which they prepared for the People’s Campaign for the Ninth Plan, reveal that inadequacy of sanitation coverage is an acute problem for women in particular, especially for those living in the coastal areas where density of population is high and public space scarce and in colonies inhabited by the

Table 6.12
Household Sanitary Latrines: Access to Sanitation Facilities

Time Line	1991 ⁽¹⁾	1995 ⁽²⁾	2001 ⁽³⁾
Rural households with toilet (%)	44	73.4	81.3
Urban households with toilets (%)	73	90.0	92.0

Source:-Census of India, 1991, (2) NSSO 1995, (3) Census of India 2001

Table 6.13
Type of Latrine within the House

	Total	%	Rural	%	Urban	%
Pit latrine	815221	12.4	631664	12.8	183557	11.1
Water Closet	4299445	65.2	3063983	62.0	1235462	74.8
Other latrine	426102	6.5	324374	6.6	101728	6.2
No latrine	1054438	16.0	922529	18.7	131909	8.0
Total	6595206	100.0	4942550	100.0	1652656	100.0

Source: Census of India, 2001

Table 6.14
Community Service Preferences

Sly. No.	Services	Preference Ranking		
		Malappuram	Palakkad	Thiruvananthapuram
1.	Water	1	1	1
2.	Latrine	2	2	3
03.	Health	3	4	2
04.	Transport	4	5	4
05.	Electricity	5	3	4
06.	Education	6	6	6
07.	Others	7	7	7

Source: NAP Formulation Report, June 1997

poor.

6.141 Two independent studies conducted by Rajeev Gandhi National Drinking Water Mission (RGNDWM) and NAP II reiterate that there is a perceived need among womenfolk for sanitary latrines, mostly in the interests of privacy and convenience though they are also aware of the health linkages of sanitary practices. The Knowledge, Attitude and Practice (KAP) survey conducted by Indian Institute of Mass Communication in 1996-97 in Thiruvananthapuram, Alappuzha and Malappuram districts shows that people are willing to spend up to Rs.3000/- for construction of household la-

Table 6.15
Need Felt For Latrine in Kerala

Sl. No.	Variables	%
01.	Reasons for Need	
	1. Better Health	32
	2. Privacy	31
	3. Convenience	46
02.	4. Old Age	1
	Reason for Not Having Latrines:	
	1. Can't Afford	95
	2. Non Availability of Materials	0
	3. No Knowledge of Details	2
	4. No subsidy	5
03.	5. Problem of Smell & Disposal	1
	Willingness to Spend	
	1. Up to Rs. 500/-	23
	2. Rs. 500 – 1000/-	14
	3. Rs. 1000 – 3000/-	10
	4. Rs. 3000/- +	1

Source: Water and Sanitation Base line survey Report, 1998 Indian Institute of Mass Communication and Rajiv Gandhi Drinking Water Mission

trines. (See Table 6.15).

Local Government Initiative

6.142 Sanitation is one of the subjects that has been transferred to the local governments at the cutting edge level, as part of the decentralization process. This has paved the way for improving the level of community participation in sanitation related services.

6.143 In the Ninth Plan about 300 Grama Panchayats gave top priority to sanitation and 50 of them achieved the goal of more than 95% coverage of the household sanitary latrines. During the Ninth Plan about 5.71 lakhs household sanitary latrines were constructed under decentralized plan campaign which is much more than the total achievement in the past 15 years through different governmental programmes.

Table-6.16
No. of Household Latrines constructed by Local Governments

1997-1998	97015	35598	3497	136110
1998-1999	106358	26231	3356	135945
1999-2000	1019293	19112	2714	141119
2000-2001	70999	11708	1304	84011
2001-2002	55867	16986	1107	73960
				571145

Source : State Planning Board

GP : General Plan, SCP : Special Component Plan

TSP : Tribal Sub Plan

Total Sanitation Campaign (TSC)

6.144 The government sponsored sanitation programmes of the nineties could not make the desired increase in the coverage of families with sanitary latrines. The major reasons contributing to this predicament were heavy reliance on subsidy, overemphasis on target and hardware, inadequate participation of stakeholders, low importance given to IEC, and limited technology op-

tions. It was in this context that the Centrally Sponsored Total Sanitation Campaign (TSC) was introduced with focus on IEC, Human Resource Development and Capacity Building. The rural areas of Kollam and Kasaragod were identified in 2001 for TSC implementation. Subsequently all other districts have also been taken up under TSC. The project cost, government share, community contribution and component activities of TSC Projects are given in Table 6.17.

6.145 TSC has the objective of generating felt demand for sanitation facilities through IEC, accelerating sanitation coverage propagating cost effective and appropriate technologies in sanitation, reducing incidence of water and sanitation related diseases and improving the general quality of life in rural areas. Strategies of TSC are as under

- Project mode of implementation
- Community led, people centred approach
- Demand Responsive Approach
- Alternate Delivery Mechanism
- Scaling down of subsidy
- Menu of technologies to meet customer preferences
- Intensive IEC

School Sanitation

6.146 Conceptually school sanitation recognizes the

potentialities of the child as a change agent more respective to new ideas. The present status of schools with sanitation and drinking water facilities is given in Table 6.18.

6.147 The TSC and Sarva Siksha Abhiyan (S.S.A) have provision for construction of school toilet. This apart, hygiene education is also an integral component of school sanitation for which school health clubs are formed.

NGO Participation

6.148 Many NGOs are active in the promotion of household latrines. Socio Economic Unit Foundation (SEUF) which was set up in 87-88 has played a major role in the sector. The Sanitation programme of SEUF has a strategy of construction along with education programme which addresses issues of construction of latrines, community motivation and participation, and education/ communication for improved sanitation and sustainability. SEUF has introduced a novel project in training women in masonry and utilizing their services in the construction of sanitary latrines. Centre of Science and Technology for Rural Development (COSTFORD), Peerumedu Development Society (PDS), Pazhakulam Social Service Society

Table-6. 17
Central Rural Sanitation Programme: TSC

Name of district	Date of sanction	Project cost (in lakhs)	Approved Share (Rs.in lakhs)			Components Sanctioned (Units)				
			Central	State	Bene	IHHL	WC	School Toilets	Balawadi toilets	RSM
Alappuzha	29.1.02	1656.13	1100.05	322.2	233.88	161871	125	377	0	10
Ernakulam	12.3.03	1058.43	514.16	274.1	270.17	54585	100	450	565	9
Idukki	12.3.03	622.19	266.75	167.4	188.04	44896	16	103	0	4
Kannur	12.3.03	804.18	349.09	219.29	235.8	559.14	14	327	0	5
Kasaragod	15.1.01	1111.86	429.26	261.98	420.62	82200	100	281	0	4
Kollam	10.1.01	895.00	597.7	174.55	122.75	85000	400	225	0	10
Kozhikkode	12.3.03	833.86	374.81	225.67	233.38	54024	21	444	0	7
Malappuram	29.1.02	759.86	510.98	152.36	96.52	69217	80	380	0	10
Palakad	12.3.03	1177.89	499.85	320.42	357.62	83059	49	289	0	7
Pathanamthitta	12.3.03	773.96	336.29	208.53	229.14	53799	25	172	100	5
Thiruvananthapuram	29.1.02	749.61	506.90	149.76	92.95	67320	60	350	0	10
Thrissur	12.3.03	546.46	258.45	144.83	143.18	33216	10	316	0	9
Wayanad	29.1.02	535.19	355.32	103.25	76.62	54927	40	78	0	3
		11524.62	6099.61	2724.34	2700.67	900028	1040	3792	665	93

Source : Commissionerate of Rural Development, Thiruvananthapuram
Abbreviations: IHHL: Individual Household Latrines, WC: Women Complex,
RSM: Rural Sanitary Marts

Table-6. 18
District wise Details of Government Schools having
Drinking Water/latrines/urinal Facilities in Kerala

District	No. of Govt. Schools			No. of Schools having							
	LP	UP	HS	Drinking Water				Urinals/Latrines			
				L.P	U.P	H.S.	Total	L.P	U.P	H.S	Total
Thiruvananthapuram	302	98	121	290	97	110	497	193	93	105	391
Kollam	269	62	75	235	59	69	363	215	52	67	334
Pathanamthitta	168	43	47	135	25	46	206	60	22	46	128
Alappuzha	194	67	58	161	48	55	264	128	51	51	230
Kottayam	169	68	59	135	64	56	255	144	65	53	262
Idukki	86	40	52	78	24	30	132	71	33	43	147
Ernakulam	186	92	90	116	84	84	284	115	75	82	272
Thrissur	121	56	80	105	48	65	218	73	40	61	174
Palkkad	193	63	59	182	58	57	297	174	55	56	285
Malappuram	346	112	82	319	110	78	507	280	92	66	438
Kozhikodu	185	76	67	161	72	63	296	130	61	42	233
Wayanadu	91	34	40	82	33	38	153	53	29	21	103
Kannur	114	77	82	100	74	76	250	79	60	67	206
Kasaragod	141	72	74	139	68	72	279	70	31	30	131
Total	2565	960	986	2238	864	899	4001	1785	759	790	3334

Source: Directorate of Public Instructions, Thiruvananthapuram

(PASS) and Centre for Environment and Development (CED) are some of the other NGOs which are working in the sector.

Bilateral Programmes

6.149 In 1987 the Danish and the Dutch governments started supporting a sanitation programme with several components, namely, household latrines, school sanitation, school health club, drainage and well chlorination.

6.150 UNICEF initiated CDD WATSAN (Control of Diarrhoeal Diseases Water and Sanitation) project in Alappuzha in 1994. Subsequently in 2001 UNICEF activities were extended to Kollam, Kottayam, Malappuram, Wayanad and Kasaragod districts. The major component activities of UNICEF Co-operation Plan were School Sanitation, Alternate Delivery System, Innovative Health Promotion, Water Quality Monitoring, Roof Top Water Harvesting, Spring Based Water Supply and Lady Mason Training. UNICEF initiative of working in partnership with Government Departments, Local Governments NGOs and communities was a crucial trend setter. This partnership went beyond funds management to sharing of ideas, and joint action. Popularising Baby

friendly toilets (BFT) in pre schools and anganwadies was a UNICEF supported innovation.

6.151 During 1998-2000 the Netherlands Government Supported the IEC activities of NIRMAL-2000, a project aimed at achieving total household sanitary latrine coverage in Kottayam District. The Netherlands' support was given to activities relating to capacity building, monitoring and documentation, school sanitation and staff cost of District level Technical Support Group whereas hardware cost was shared between Government of India and Government of Kerala.

6.152 In 2000, a World Bank supported Rs. 451 Crore Water Supply and Sanitation Project was launched in Thrissur, Palakkad, Malappuram and Kozhikode districts. 80 Grama Panchayats from within the above four districts have been identified for project implementation.

Urban Programmes

6.153 A Centrally Sponsored Scheme for Low Cost Sanitation and Liberation of Scavengers was launched in the urban areas in 1980-81. The main objective of the scheme is to convert existing dry latrines in to low

cost pour flush latrines and to provide alternate employment to the liberated scavengers. The funding pattern is shown in Table-6. 19.

6.154 The subsidy at the rate indicated in the table is

Table-6. 19
Funding Pattern

Category	Subsidy	Loan	Beneficiary
EWS	45%	50%	5%
LIG	25%	60%	15%
MIG&HIG	Nil	75%	25%

borne by Central Government. The guidelines permit state government to subsidise loan component and/beneficiary share. From 1989 onwards the scheme is implemented with HUDCO assistance.

6.155 The National Slum Development Programme (NSDP) was launched in 1997-98. The implementation of the scheme is through Kudumbasree. The urban local government are free to earmark funds for the construction of sanitary latrine with a unit cost of Rs. 2,000/-. The scheme is exclusively meant for BPL families. Under the Kerala Development Programme also urban local governments set apart plan funds from the service sector for construction of sanitary latrines for the BPL families. The unit cost of individual household sanitary latrine is Rs. 2,000/-.

Gender Issues

6.156 The growing emphasis on gender and development (GAD) issues has helped in mainstreaming women's perspectives in sanitation projects. The SHG movement which began in the mid-nineties also represents a powerful potential for poor women's participation in WATSAN Sector. The recent projects in sanitation sector perceive a clear shift in women's role as domestic level sanitation and hygiene manager to an active participant contributing significantly to the efficiency and effectiveness of project implementation. Analysis of the Local Government managed projects would also reveal that women are no longer seen as clients of the system but as agents of change. (eg. Alappad Panchayat where situation analysis of women preceded programme designing and implementation). These initiatives have proven that incorporating women's perspective could change priorities and implementation dynamics. The empowerment of women needs to be viewed as a potentially powerful instru-

ment to resolve some of the complex issues in the sector.

Kerala Total Sanitation and Health Mission (KTSHM)

6.157 In 1998 three Centrally Sponsored IEC projects were launched in Thiruvananthapuram, Alappuzha and Malappuram districts. These projects focused on social marketing for promotion of sanitation and sanitary aspects of water supply. A State level IEC Cell headed by a Consultant was set up in the Rural Development Department in 1998. In the year 2000, the Kerala Total Sanitation and Health Mission was set up as an autonomous agency, and the IEC Cell was merged with the Mission. The Mission has the mandate for developing conceptual framework, formulating programme strategies, providing expert consultancy and building sector related capacities of local governments. The Mission has expertise in strategy setting, model building and capacity building in WATSAN Sector.

Solid Waste Management

6.158 Any waste other than human night soil and sullage is called solid waste. It 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. Municipal Solid Wastes (Management and Handling) Rules, 2000 define solid waste as commercial and residential wastes generated either in solid or semi solid form, excluding industrial hazardous wastes, but including treated biomedical wastes.

6.159 The Supreme Court of India in the judgment in a Public Interest Litigation (Writ Petition No.888 of 1996) constituted an eight member Committee with Shri. Asim Burman as Chairman to look into all aspects of Solid Waste Management in Class I cities in the country. The Committee submitted an Interim Report in June, 1998 recommending (i) actions to be taken by urban local governments and (ii) support measures to be extended by Central and State Governments. The Committee submitted its final Report in March, 1999 recommending simple technologies, easily achievable standards and a liberal timeframe. The Supreme Court accepted the report of the Committee and issued directives to the Central and State Governments to take steps to implement the recommendations.

6.160 In the light of the Supreme Court Judgment, Government of India notified comprehensive rules for Municipal Solid Waste Management. As per Supreme Court directive local governments having a population above one million are required to set up waste processing and disposal facilities by 31/12/2003 or earlier.

6.161 Urban solid waste is presently being disposed of unscientifically by dumping it in disposal yards. Such operation of open dumping results in unpleasant odour and air pollution; generation of leachate polluting ground water and surface water; and fly and mosquito breeding. In order to find a lasting solution to the problem of solid waste management, government launched the Clean Kerala Programme in 2003 for which it has set up the **Clean Kerala Mission**. The Mission has the responsibility of capacity building of local governments in the preparation and implementation of solid waste management plan. The objective of "Clean Kerala" is to strengthen the managerial capacity and responsibility of the community and local governments in planning, implementation and maintenance of solid waste management facilities and services and to help local governments establish socially acceptable, operationally sustainable and financially viable Solid Waste Management facilities and services.

6.162 At present, the quality of services related to solid waste collection and disposal is extremely poor. There is an urgent need to streamline solid waste management systems, including collection and transportation, and more significantly waste treatment and disposal systems. It is estimated that only about 50% of the 2500 tonnes of waste generated per day is collected for disposal. Every day a quantity of about 1200 tonnes of waste is left to decompose on road margins, drains, canals, water bodies and open space. Such a situation provides ideal breeding ground for pathogens and disease causers. Even more serious is the problem of ground water pollution due to leachate from disposal sites. Wind blown debris and burning of wastes invariably cause air pollution. There is a sharp increase in the presence of substances like plastics which are difficult to degrade or break down, in the waste stream. Bio medical waste has been a growing concern because of the emergence of diseases like AIDS and Hepatitis.

6.163 Domestic waste constitutes 28% of solid waste

and consists of food waste and other discarded materials. Trade and institutional waste also forms bulk of the solid waste whereas construction and demolition waste accounts for 6%. (See Table 6.20).

6.164 An analysis of the composition of solid wastes

Table-6. 20
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	8

Source: Hand Book on Water and Sanitation, 2002

shows that it contains 68% biodegradable wastes (see Table 6.21). The remaining 32% consist of non-bio degradable components like plastic, bottles, metal parts, rubber, construction materials etc. Among these, items like paper, plastics, glass and metal pieces can be recycled or reused. There are a large number of rag pickers in the informal sector who collect recyclable materials from households, streets, bins and disposal sites.

6.165 In the present solid waste management systems,

Table-6. 21
Composition of Solid Waste

Sl. No.	Component	Percentage
1.	Biodegradable	68
2.	Cloth, Timber	20
3.	Plastic, rubber, glass metal	7
4.	Brick etc.	5

Source: Handbook on Water and Sanitation, 2002

little attention is given to proper equipment design. Open, bottomless community bins, box type carts and non tipping trucks are still being used necessitating open storage and multiple handling of waste. The most critical deficiency is that proper disposal sites have not been identified by most of the urban local governments. Those who have their own sites are yet to develop the site for sanitary land fill.

Issues

6.166 The key issues related to the different component activities of solid waste management as perceived in the Clean Kerala initiative are given below.

- The process of segregation and storage of waste at source is generally absent. This has resulted in a disorganized and ad hoc primary collection system
- Inadequately equipped primary collection points have necessitated waste dumping along roadsides and open space.
- Multiple handling of waste in different stages and irregular street sweeping have resulted in inefficient waste transfer and littering.
- Inappropriately designed street cleaning implements and primary collection vehicles have contributed to system inefficiency
- Several open grounds are used as secondary collection points. This practice has led to creation of leachate and contamination of groundwater
- Uncovered transportation of waste in tractors and conventional trucks has resulted in littering en route the disposal site.
- Inadequate and ill designed vehicles, under-utilisation of existing vehicles due to frequent break-downs coupled with delay in repairs have added to inefficiency.
- Crude waste dumping in land fill site has provided breeding ground for pests and rodents apart from ground water contamination.
- Poor civic sense
- Weak institutional structure and inadequate technical skills and expertise
- Low priority of solid waste management and insufficient funds allocation for meeting capital and operating cost.

Strategic Consideration

- "Clean Kerala" has taken in to consideration the following factors in upgrading solid waste management system.
- Awareness of citizens' role (environmental and local communities)
- Waste has to be segregated and stored at the source of generation
- Waste should not be allowed to reach the ground at any level of storage, collection and transport
- Equipment and vehicles will have to be designed in such away as to avoid manual handling
- Resource recovery by composting the organic fraction
- Informal sector may be supported in its efforts to salvage the recyclable fraction

- Non-biodegradable inerts and rejects must be land filled and that too in properly located secured site adopting environmentally acceptable procedures
- Training and capacitation of all solid waste management personnel, elected functionaries and the CDS system
- Developing MIS for effective monitoring
- IEC and awareness building for community participation
- Campaign mode of implementation

6.167 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 prolonged monsoon season, it is not practicable to adopt thermal process in Kerala. Therefore the most suitable method of disposal of solid waste that can be adopted in the State is aerobic composting. For centralized composting the simplest system is windrow composting, and for decentralized treatment at household level and in residential colonies vermi-composting is suitable. For a quantity up to 50 MT, manual composting is sufficient and, for wastes exceeding a quantity of 50 MT mechanized windrow composting can be recommended.

6.168 In windrow composting plant each day's wastes are heaped in a windrow of 1.5 m height. After 21 days, compost is extracted by crushing and sieving process. Thereafter compost is kept for 30 days in a maturation yard for stabilization. Capital cost for establishing a 50 MT windrow compost plant will come to Rs.60 lakhs. The annual operation and maintenance cost will be Rs.45 lakhs. The sale of compost at the bare minimum price of Rs.1.50 per kg would fetch annually an amount of Rs. 67 lakhs.

6.169 Vermi composting method can be practiced in households, offices and other institutions. For home composting a container of a size of 90 cm diameter and 45 cm depth can be made use of. Initially a layer of soil and cow dung slurry will be made. On the top of this, domestic organic waste will be spread along with earth worms as a subsequent layer. Water should be sprinkled occasionally. 25 days wastes generated by a family of 5 members can be processed in such a container.

Cost Implications

6.170 The capital and O&M costs of introducing solid waste management system for a municipality of 1 lakh population are separately worked out and given in Tables 6.22 and 6.23 respectively.

Table-6. 22
Capital Cost for Introduction of MSW System

Sl. No.	Item	Number	Amount (Rs. in lakhs)
01.	House hold bins @ Rs. 50	60,000	30.00
02.	Hand cart of 300 lit. capacity @ Rs. 0.15 lakhs	60	9.00
03.	Tricycle for house to house collection @ Rs. 0.20 lakhs	40	8.00
04.	Community bin		
	i) Dumper container of 25000 lit. @ Rs. 0.01 lakhs	85	0.85
	ii) Containers 2.5 m3 @ Rs. 0.30 lakh	24	7.20
	iii) Litter bins @ Rs. 0.01 lakhs	50	0.50
05.	Cost of sweeping tools		
	i) Containerised cart @ Rs. 3000	75	2.25
06.	Transportation		
	Dumper placer @ Rs. 10 lakhs	2	20.00
	Dual loader @ Rs. 8 lakhs	1	8.00
07.	Home Vermi Composting for a family of five members @ Rs. 600/pit (90cm dia of 45 cm deep, 1:2:4 concrete 2 pits)	20,000 x 2	24.00
08.	Aerobic Composting 50 tonnes/day Processing area 100 x 90m 21 windrows each of 50 tonnes and maturity yard of 600 m2 for storing raw compost (30 days storage) capital cost	-	60.00
09.	Sanitary land fill	-	20.00
10.	Bio medical waste treatment common facility	1	
	i) Incinerator of double chamber of capacity 30 Kg/hr, 3 shifts		15.00
	ii) Autoclave of capacity 30 Kg/hr, 2 shifts		15.00
	iii) Shredder, 3000 Kg/hr		3.00
	iv) Land development and civil works		15.00
	v) Sundries		2.00
11.	Civil work – flooring container stations, bin locations; Processing/Disposal plant accessories		5.00
	1. Site development		
	2. Weigh Bridge		15.00
	3. Compost Plant		8.00
	4. Vermi Compost Unit		4.00
	5. Support to home composting - vermi kits		2.00
			3.00
12.	Setting up basic tools for vehicle repair		3.00
13.	Community awareness/ Training for staff		3.00
14.	Sundries		1.20
	Sub Total		284.00
	Less Cost of home composting unit/ household bins and bio-medical waste		104.00
	Total		180.00

(Abstract of cost excluding land cost)

Table –6.23
Operation and Maintenance
(Cost per annum)

Sl. No.	Item	Amount (Rs.in lakhs)
i)	House to house collection @ Rs. 20 per month in 20,000 households	48.00
ii)	Street Sweeping – 152 labour @ Rs. 4,000 per month	72.90
	i) Containerised cart 6 bins, 50 lit. = 75 No. @ Rs.3000	2.25
	ii) Long handle broom 100 nos. @ Rs. 75 each	
	iii) Metal tray, fork and metal plate 100 nos @ Rs. 200/set	0.075
	iv) Shovel for drain cleaning, wheel barrow @ Rs. 400/100 nos	0.05
	v) Protective gear such as gloves, boots etc. 16 nos. @ Rs. 500 per set	0.10
		0.8
iii)	Transportation @ Rs. 1000 per day/ vehicle	7.20
iv)	Aerobic Composting	
	a) Labour	
	i) Turning, breaking windrows, sorting 30 men @ 50,000/year/head	15.00
	ii) Plant operation, 7 men @ 50,000/year/head	3.50
	iii) Driver/@ 80,000/year	
	b) Tools and equipment	0.80
	i) Maintenance replacement	
	ii) Fuel, power	1.00
	iii) Packing, marketing	1.50
	iv) Management supervision	3.00
	c) Amortization @ 20% of capital cost	5.00
		12.00
v)	Sanitary Landfill	
	i) Cell formation - internal road	2.00
	ii) Cover material	3.25
	iii) Labour for leveling, covering	3.50
	iv) Hiring of dozer for immediate compaction intermediate cover – twice annually	3.00
	Leachate control monitoring - cut off drains	2.25
vi)	Bio-medical Waste treatment at common facility center	30.00
vii)	Sundries	6.90
	Sub Total	221.00
	Less House to house collection and biomedical waste management	78.00
	Total	143.00

Source: S.W.M: Reading Material: 2002 KTSHM

6.171 The total capital cost in setting up an integrated solid waste management system in an urban local government with 1 lakh population would be about Rs.180 lakhs. The urban local governments in the State can be categorized into four on the basis of population for the purpose of computing the total rough cost estimate of introducing solid waste management systems.(Table 6.24).

Table – 6.24
All Urban Local Governments: Total Capital Cost

Sl No.	Population	No. of ULGs	Cost of SWM (Rs. in lakhs)
01.	> 2 lakhs @ Rs. 300 lakhs	5	1500
02.	1-2 lakhs @ Rs. 180 lakhs	2	360
03	50000 – 1 lakh @ 135 lakhs	21	2835
04	25000 – 50000 @ Rs. 68 lakhs	30	2040
	Total	58	6735

6.172 Accordingly, the rough cost estimation of installing solid waste management systems (excluding land cost) in all the urban local governments in the State will work out to Rs.6735 lakhs.

6.173 A rough estimation of the own revenue available with urban local governments is given in Table – 6.25.

6.174 At present urban local governments spend 20-30% of their revenue for solidwaste management. It is possible for the KUDFC to arrange loan, the principal of which can be repaid from plan funds and interest from own revenue. For the upkeep and maintenance of solid waste management system a f u n d

could be set up at municipal level with resources flowing in from municipal funds, user charges, penalties imposed, sales proceeds of compost etc.

Information, Education and Communication (IEC)

6.175 Solid Waste Management is an activity in which public participation is the key to success. It is not the technology alone, but public attitude and behaviour and the efficiency and effectiveness of the systems and practices also that determine the success of a solid waste management system. A system demanding segregation and storage of waste at source would require a very high degree of human behaviour change. Hence IEC will focus on:

- Reduce, Reuse Recycle and Recover – 4 Rs
- No waste on ground
- Segregation and storage at source
- Waste processing and disposal at local level
- Willingness to pay for services
- Reaching out to the people – develop methodology for community mobilization and participation
- Making community aware of the health risks emanating from the present system and the need for upgradation
- Zero waste concept
- Participation of community in deciding options

Rural Scenario

6.176 Solid Waste Management Systems are practically non-existent in the Panchayats. This is inspite of

Table – 6.25
Own Funds of Urban Local Governments

Population	No. of Urban Local Governments	Own Revenue (A)	Expenditure on salary, OE, street light, water supply, public health (B)	Balance funds (A-B)
>72 lakhs	5	7693.37	4135.67	3557.7
1-2 lakhs	2	864.26	545.35	318.91
50000 – 1 lakh	21	4171.13	2283.39	1887.74
25000-50000	30	3767.78	2265.54	1502.24
Grand Total	58	16496.54	9229.95	7266.59

Source: Directorate of Urban Affairs

the fact that the State is a rural – urban continuum with high density of population. The average per capita, per day, waste generation in rural areas is estimated to be around 210 gm. In the context of the high density of population of Kerala Panchayats, this is poised to become a serious health and environmental problem in the near future. As solid waste management is an important obligatory function of the local governments, there is an urgency to build up capacities of grama panchayats in this relatively complex sector. The rural local governments would need policy support, institutional support and technical support in strengthening their internal capabilities in this sector.

6.177 It is also possible to introduce “zero Waste” concept in the rural sector with the aid of well designed IEC packages. At any rate, the approach to solid waste management systems and practices in rural areas should necessarily be based upon centralized planning and co-ordination with decentralized implementation.

Bio Medical Waste

6.178 Treatment and disposal of bio-medical wastes generated from hospitals should be done as per the Bio-medical Waste (Management and Handling) Rules, 1998. It is the responsibility of waste generator to treat and dispose of the bio-medical waste. Whereas local governments have to assist the hospitals, if they come forward for establishment of a Common Treatment Facility, by identifying suitable land, it is the responsibility of the local bodies to treat and dispose the non biomedical waste (general waste) and treated bio-medical waste generated in the healthcare institutions. The Kerala State Pollution Control Board (PCB) is the prescribed authority to implement Bio-Medical Waste (Management and Handling) Rules in the state.

6.179 As per 1991 Census, Kerala has the highest number of hospitals (26%) in India. The Report on Private Medical Institutions in Kerala published by the Department of Economics and Statistics (1995) shows that there are about 12618 private medical institutions for all systems of medicines combined.

Table-6. 26
Hospitals in Kerala

No. of Hospitals	5000
Bed strengths : Government	40000
Bed Strength : Private	58000
Bio-medical Waste Generated	30 T/Day
General Waste Generated	170 T/Day

Source: State Pollution Control Board, 1998

6.180 It is roughly estimated that the solid and liquid waste generation per hospital bed is 1.3 to 2.0 kg and 450 litres respectively. About 85% waste generated in hospitals is general waste and can be handled as other solid wastes. The remaining 15% constitutes infectious and toxic wastes. (Table 6.27) More often than not, the general wastes in hospitals and bio medical wastes are allowed to mix thereby rendering the general waste also toxic and hazardous.

Table –6.27
Composition of Hospital Waste

Infections Waste	10%
Toxic Waste	5%
General Waste	85%

Source: State Pollution Control Board

6.181 As per rules, Bio medical waste is to be collected in four different coloured bags. Human body parts and others are to be collected in yellow coloured bags and should be incinerated. Disposable items like IV sets, Blood and Urine bags are to be collected in red coloured bags and should be autoclaved for disinfection. Needles, syringes and other sharps are to be collected in blue coloured bags and after autoclaving/chemical treatment should be cut into small pieces. Discarded medicine, incinerator ash, chemical waste etc. can be collected in black coloured bags and should be disposed of in secured landfill site.

6.182 Minimum required facilities to be installed in a hospital for biomedical waste treatment include one Incinerator, one Autoclave and one Shredder. According to a rough cost estimate each hospital may have to make a capital investment of Rs.10 lakhs for acquiring these facilities. Therefore, installation of Common Treatment Facility for a given consortium of hospitals appears to be a more viable option. In a 5,000 bedded

hospital, 7.5 MT of waste is generated per day. Out of this 1.25 MT would be bio-medical waste. The estimated capital cost for establishing a common treatment facility for bio medical waste generated from 5,000 hospital beds is given in Table 6.28. The annual O&M cost will come to Rs. 30 lakhs.

Table – 6.28
Bio-medical Waste Management System: Capital Cost

Sl. No.	Facility	Amount in Lakhs
1.	Incinerator (2 chamber 30 KG/hr. Capacity)	15.00
2.	Autoclave (30 KG/hr. Capacity)	15.00
3.	Shredder (3,000 KG/hr. Capacity)	3.00
4.	Land Development and Civil works	15.00
5.	Other items	2.00
Total		50.00

(Land requirement: 2 acres)

Source: State Pollution Control Board

Liquid Waste Management

6.183 Stagnant pools of waste water around houses, water sources, streets and in clogged drains are a health hazard. They smell foul, provide breeding place for mosquitoes and contaminate the drinking water sources. Household waste water which is commonly called sullage is generated in the toilets, the bath rooms, and the kitchen. Though harmless at the point of generation, its accumulation and stagnation will lead to unhygienic condition mainly due to putrefaction of the organic contents. Soakage pit is the most inexpensive and easiest method of sullage disposal. Community perception of sullage disposal and the prevailing practices are given in Table 6.29. Though there is a general awareness about the harmful effects of waste water, 48% of households let waste water stagnate in their backyards.

6.184 In the absence of proper drainage facilities waste water from market places, slaughter houses, poultry farms, fish markets, hotels and garbage dumps finds its way to natural water bodies. Inadequate drainage provision causes storm water to ultimately find its way to low lying areas leading to water stagnation.

6.185 At present there is no proper waste water disposal systems in panchayats. But in towns and cities at least partial and rudimentary attempts have been made for liquid waste management. All the city corporations have a system of drainage channels which drain both waste water and storm water. 23% of the households in Thiruvananthapuram city and 15% houses in Kochi Corporation have access to common sewage collection system.

Safe Handling of Drinking Water

6.186 There is always a possibility of drinking water getting polluted at collection, transport or storage points. Observations show repeated hand contact with drinking water during collection, transportation, storage, serving and consumption, and this is an active route of contamination. Pocket Chart Exercise carried out in three selected panchayats to find out practices related to water handling is given in Table 6.30.

Table –6.29
Disposal of Waste Water (in %)

Sl. No.	Variables	Kerala
01.	Disposal	
	I. Soak Pit	6
	II. Open Pit	13
	III. On the street	4
	IV. In Backyard	48
	V. In Drain Connected with Main	2
02.	Perception About Safe method of Disposal of Waste Water:	
	I. Kitchen Garden	27
	II. Soak Pit	15
	III. Open Pit	17
	IV. Drain	18
	V. Do Not Know	6
03.	Stagnant Water Causes:	
	I. Spreads Disease	35
	II. Causes Inconvenience	3
	III. Smells Bad	13
	IV. Breeds Mosquitoes	65

Source : Water and Sanitation Base line survey Report 1998
Indian Institute of Mass Communication and Rajiv Gandhi
Drinking Water Mission

Table –6. 30
Water Handling

Sl. No.	VARIABLE	Thrikkunnappuzha	Puthenchirra	Kuttiyattor
Figures	Number of Participants	32	22	22
1.	Fingers dipped in glass while serving water	9	16	3
2.	Collecting water, dipping hands up to half in bucket	10	14	4
3.	Taking water using a long handled cup	1	2	9
4.	Taking water by titling the water pot	2	16	6

Source : Kerala Hygiene Evaluation Study 1996, London School of Hygiene and Tropical Medicine and SEUF

6.187 Generally people consider the water they use for drinking and cooking as clean and safe. For a vast majority of people safe water is that which “looks clean”. “Tastes good” was considered an attribute of safe water by 20% “Water free from germs” is considered safe only by 30% of the respondents. (Table –6. 31).

Table – 6.31
Perception about the Quality of Water used
(Multiple Response)

Sl. No	Variables	(in %)
		Kerala
1.	Drinking Water:	
	I. Clean	95
	II. Safe	92
2.	Cooking Water:	
	I. Clean	95
	II. Safe	92
3.	Attributes of Safe Water:	
	I. Looks Clean	60
	II. Tastes Good	20
	III. Free from Germs	30
	IV. Cooks Food Well	4

Source : Water and Sanitation Base line survey Report 1998. Indian Institute of Mass Communication and Rajiv Gandhi Drinking Water Mission

6.188 The practice of cleaning and covering the vessels used for water storage has a direct bearing on health. For cleaning, people use water (5%) and ash and water (18%). Covering of vessel is a common practice (79%).

6.189 Massive extension in supply of safe drinking water cannot make an appreciable impact on the health of the poor people without improved hygiene behaviour. This can be overcome only with hygiene awareness promotion based on location specific water handling practices, including the need for keeping the water source neat and clean.

6.190 The local governments have a key role in this regard. They can seek support of PHCs and Kerala Water Authority, and Kerala Rural Water Supply Agency in the Jananidhi Project areas.

Table – 6.32
Storage of Water
(Multiple Response)

Sl. No	Variables	(in %)
		Kerala
1.	Cleaning of Vessel:	
	I. Water	5
	II. Water & Ash	18
	III. Water & Soap	0
2.	Covering of Vessel:	
	I. Always	79
	II. Mostly	14
	III. Sometimes	1
3.	Purification:	
	I. Cloth filter	7
	II. Chlorine	5
	III. Candle filter	0
	IV. Boiling	84
	V. Alum	0
	VI. Seeds	2

Source: Water and Sanitation Base line survey Report 1998

Home Sanitation and Food Hygiene

6.191 Kerala houses bear a 'visible cleanliness' within the household. Traditionally cooking, eating and sleeping areas are kept clean but the surroundings are often made dirty by waste water and garbage generated by the household. The fact that almost no-cost simple sanitation measures like household soakage pit and garbage pit are not universally practiced reflects lack of public awareness of such simple interventions. The initiatives taken by Pilicode Panchayat in Kasaragod district and Mattathur panchayat in Thrissur district prove that local governments can bring about positive changes in household sanitation.

6.192 Prevention of food borne diseases is a major sanitation concern. Many of the reported cases of food borne illnesses are caused by bacteria. Improper storage of food; improper washing of hands and finger nails; cross contamination; improperly cleaned eating and cooking utensils, work areas and equipments; and contamination through flies, cockroaches and other pests are the major routes of food contamination. The local governments have an enabling role in promoting food hygiene awareness with the support of Health Staff and C.D.S. System.

Personal Hygiene

6.193 Personal hygiene encompasses all the acquired individual attributes that are necessary for a healthy life. Conventionally, personal hygiene focuses on safeguarding physical health alone and will comprise of three factors, namely, (i) body hygiene, (ii) clothe hygiene and (iii) health habits and attitudes. The activities associated with personal hygiene include rec-tal cleaning after defecation, washing hands, brushing teeth, clipping nails, bathing, using clean clothes particularly under garments, genital cleaning, menstrual hygiene etc. It is also important to do away with unhygienic habits like picking nose, spitting indiscriminately, coughing and sneezing without covering the mouth etc. Epidemiological investigations have shown that even in the absence of latrines, diarrhoeal morbidity can be reduced with the adoption of improved hygiene behaviour. Personal hygiene practices are in a way the starting points of altering negative behaviours in other domains of sanitation. The RGNDWM studied hand washing practices before eating and feeding the child and after defecation. Hand washing before eating and after defecation is almost universal (Table 6.33).

Table – 6.33
Health & Hygiene Habits in Kerala
(Washing Hands)

Sl. No.	Variables	%
01.	Wash Hand Before Eating:	
	I. Water	83
	II. Water & Soap	17
	III. Water & Ash	0
	IV. Water & Sand	0
02.	Wash Hand Before Feeding Child:	
	I. Water	44
	II. Water & Soap	12
	III. Water & Ash	0
	IV. Water & Sand	0
3.	Wash Hand After Defecation:	
	I. Water	48
	II. Water & Soap	50
	III. Water & Ash	0
	IV. Water & Sand	0

Source : Water and Sanitation Base line survey Report 1998
Indian Institute of Mass Communication and Rajiv Gandhi
Drinking

Water Mission (% age do not add up to 100.00 in all cases
as "others" are not shown in the table)

6.194 Personal hygiene education needs to start from the family. A multi-pronged IEC strategy is needed to enter into this private space without being intrusive. It is ideal to target children in this regard. Anganwadi sanitation and school sanitation also assume significance and local governments will have a critical role to play as facilitator and catalyst.

Community Environmental Sanitation

6.195 One of the factors that has contributed to Kerala's growing environmental sanitation problems is its high density of population. Lack of basic amenities compel people to resort to insanitary practices. The matter has been further aggravated by inadequate garbage disposal and drainage. The high population density, burgeoning consumerism and increased demands on civic facilities tell upon the bearing capacity of Kerala's already fragile environment. This is particularly true

of the coastal area, which is characterized by high water table and high population density. Community latrine system is comparatively rare in Kerala. It would be necessary to propagate community latrines as one of the effective options. Community toilet can also serve the floating population in markets, bus stand and other public places. Major deficiencies in the existing community latrine system are (i) lack of cleanliness and poor up-keep, (ii) inadequate water supply and lighting, (iii) inappropriate location (iv) insecurity (especially for women) and (v) poor operation and maintenance. Before deciding on community latrine, it would be necessary to undertake a community preference assessment to reveal effective demand for such a service. One of the component activities of TSC is construction of sanitary complexes for women by providing total facilities for water supply, bathing, defecation and washing in places where adequate space is not available within households and workplaces.

6.196 Solid and liquid wastes originating from public places, markets, institutions, work places, public streets, agricultural fields, bus stands, pilgrim centres etc. lead to community environmental sanitation problems.

6.197 Most of the canals and rivers flowing through the urban areas have become dysfunctional dumping space of the leftovers of hotels and slaughterhouses, carcass and heaps of plastic wastes which make them very unhygienic. The indiscriminate use of chemical fertilizers and pesticides has become a matter of serious concern. The prevailing state of affairs calls for a comprehensive approach to tackle the drinking water and environmental sanitation problems. Nevertheless a vast majority of the prevailing sanitation problems can be resolved without any costly installations. The most critical factor in this direction would be inculcating proper attitudes, habits and civic sense in the community. The local governments will need to ally with the other key players in the sector in their efforts in making the environment clean. A clean environment will be a generic indicator of the hygienic practices of people living in it and of good governance as well. An immediate restoration of a 'clean Kerala' is a *sin qua non* for preventing outbreak of communicable diseases, maintaining the high health status and well-being of the people and even from an economic point of view for higher productivity and retaining the attraction of tourists.