CHAPTER I

GENERAL

Area and Population

Add to Part I, Page 5, after IInd Para:

KARNATAKA with an area of 1,91,791 sq.km (and not 1,92,204 sq.km as stated in the previous edition) accounts for 5.83 per cent of the total geographical area of the Country (32.88 lakh sq.km). The population of the State according to 1991 Census was 44,977,201 with 22,951,917 males and 22,025,284 females as against a population of 37,135,174 in 1981 and 29,299,014 in 1971. Karnataka State ranks eighth among the 25 States and 7 Union Territories in the Indian Union both in respect of area and population as per 1991 Census. Uttar Pradesh, Madhya Pradesh, Bihar, Maharashtra, West Bengal, Andhra Pradesh and Tamilnadu States have larger population than Karnataka. Bangalore (Urban) district is the smallest district sharing only 1.14 per cent of the State's area, preceded by Kodagu district (2.14 per cent). Bangalore district which is the smallest in area, has highest population and density (the average number of persons per sq.km) among the districts in the State. The extraordinary high density of Bangalore district *i.e.*, 2,203 is due to the high density of the Bangalore Urban Agglomeration area (which comprises 85.16% of the total population of Bangalore district). Kodagu district has the lowest population (1.08%) and density (118) among the districts.

Bangalore Urban Agglomeration accounts for 85.16% of the population of Bangalore district and 9.12% of the population of the State. Karnataka's growth rate during 1971-81 was 25.75 per cent and it has fallen to 21.12 per cent for the decade 1981-91. Karnataka's growth rate which was above

the national average (24.66%) has now come down below the national average (23.85%). The density of population has increased from 194 (1981) to 235 (1991). The corresponding figures for the Country are 273 (1991) as against 230 in 1981. Karnataka has only one city with more than a million population *viz.* Bangalore and it is the sixth largest Urban Agglomeration in the Country as per 1991 Census. Formerly it held the fifth place (1981).

During 1986, the Government of Karnataka bifurcated Bangalore district into Bangalore (Urban) and Bangalore Rural districts, thereby raising the number of districts to 20. The jurisdiction of the present Bangalore district covers Bangalore North (including Jala hobli of the former Devanahalli taluk and Dasanapura hobli of the former Nelamangala taluk), Bangalore South taluk (including Tavarekere hobli of the former Magadi taluk and Bidarahalli hobli of the former Hoskote taluk), Anekal taluk and the Bangalore Urban Agglomeration areas. The remaining areas of the former Bangalore district constitutes the present Bangalore Rural district. The State has four revenue divisions, 49 sub-divisions, 20 districts, 175 taluks, 745 hoblis and 27,024 inhabited villages. As per the Karnataka Zilla Parishad, Taluk Panchayat Samitis, Mandal Panchayats and Nyaya Panchayats Act enforced in 1987 there were 2,532 Mandal Panchayats with 54,987 members (excluding interim mandal panchayat members), 887 Zilla parishad seats, 27,024 inhabited and 2,362 un-inhabited villages, 250 towns and urban agglomerations and 177 municipalities and corporations. Three-hundred and fifty hobli head quarters have Nadakacheris.

The details of area, population and administrative divisions of Karnataka State as in 1991 are given in Table No. 1.1

Territorial Changes

Add to Part I Page 6 at the end:

Referring to the inter-district transfers after the re-organisation but before 1961, two villages *viz.* Mydanahalli and Kurgahalli of Shrirangapattana taluk in Mandya district were transferred to Mysore taluk in Mysore district (1957). During the decade 1961-71 there were no major changes in the jurisdiction of the districts except for the transfer of two villages namely Tallihal and Honniganur of Kushtgi taluk, Raichur district to Ron taluk, Dharwad district (1967). During the decade 1971-81 the new taluk *viz.* Hagaribommanahalli was created by abolishing the former Mallapura taluk and by transferring of a few villages from various taluks of Bellary district (1974).

The jurisdiction of Karnataka State extends over portions of land situated within the Maharashtra State. Dhamne S. Bailur and Kudrimani, two villages of Belgaum taluk with an area of 1,664 hectares and a population of 262

Table No. 1.1 Area, Population and Administrative divisions in Karnataka - 1991

Sl.No	District	Area in Sq.km	Percent of State's area	Population in 1981	Rank	Population in 1991	Rank	Decennial Growth Rate 1971-81	Decennial Growth Rate 1981-91	Density per sq.km 1981	Density per sq.km 1991
1.	Bangalore	2,190	1.14	3,495,566	1	4,839,162	1	59.08	38.01	1,596	2,203
2.	Bangalore Rural	5,815	3.03	1,452,044	14	1,673,194	14	24.31	14.71	250	286
3.	Belgaum	13,415	6.99	2,978,913	2	3,583,606	2	22.94	18.18	222	262
4.	Bellary	9,885	5.15	1,489,225	13	1,890,092	13	32.65	27.09	151	191
5.	Bidar	5,448	2.84	995,691	18	1,255,799	17	20.83	25.65	183	230
6.	Bijapur	17,069	8.90	2,401,782	5	2,927,990	5	20.96	21.35	141	171
7.	Chikmagalur	7,201	3.75	911,769	19	1,017,283	19	23.77	11.52	127	141
8.	Chitradurga	10,852	5.66	1,777,499	11	2,180,443	11	27.21	22.51	164	201
9.	Dakshina Kannada	8,441	4.40	2,376,724	6	2,694,264	6	22.55	13.27	282	319
10.	Dharwad	13,738	7.16	2,945,487	3	3,503,150	3	25.76	18.79	214	255
11.	Gulbarga	16,224	8.46	2,080,643	7	2,582,169	7	19.63	23.71	128	159
12.	Hassan	6,814	3.55	1,357,014	16	1,569,684	16	23.11	15.43	199	230
13.	Kodagu	4,102	2.14	461,888	20	488,455	20	22.11	5.05	113	118
14.	Kolar	8,223	4.29	1,905,492	9	2,216,889	10	25.64	16.05	232	269
15.	Mandya	4,961	2.59	1,418,109	15	1,644,374	15	22.85	15.91	286	331
16.	Mysore	11,954	6.23	2,595,900	4	3,165,018	4	24.97	21.58	217	264
17.	Raichur	14,017	7.31	1,783,822	10	2,309,887	8	26.01	29.33	127	165
18.	Shimoga	10,553	5.50	1,656,731	12	1,909,663	12	27.31	14.71	157	180
19.	Tumkur	10,598	5.53	1,977,854	8	2,305,819	9	21.51	16.36	187	217
20.	Uttara Kannada	10,291	5.37	1,073,561	17	1,220,260	18	26.38	13.49	104	118
	State total	191,791	100.00	37,135,714		44,977,201		26.75	20.69	194	234

Source: Final Population Totals, Census of India, 1991, Series 11, Karnataka.

(Continued)

Table No. 1.1 (Continued)

Sl. No.	District	Number of subdivisions	No. of Taluks	No. of Hoblies	No. of Grama Panchayats	No. of inhabited Villages	No. of uninhabited Villages	No. of Towns and urban Agglomerations	No. of Municipalities and Corporations
1.	Bangalore	1	3	17	-	718	52	2	5
2.	Bangalore Rural	2	8	35	103	1,707	177	9	8
3.	Belgaum	3	10	35	202	1,142	36	19	17
4.	Bellary	2	8	31	91	589	24	12	10
5.	Bidar	2	5	30	74	598	22	6	5
6.	Bijapur	4	11	36	166	1,244	37	19	18
7.	Chikmagalur	2	7	32	112	1,013	100	10	5
8.	Chitradurga	2	9	30	121	1,266	216	10	5
9.	Dakshina Kannada	3	8	26	169	635	-	17	11
10.	Dharwad	4	17	44	166	1,322	40	22	19
11.	Gulbarga	3	10	48	169	1,305	81	15	12
12.	Hassan	2	8	38	109	2,371	199	12	6
13.	Kodagu	1	3	16	65	288	8	10	1
14.	Kolar	2	11	53	129	2,848	477	13	10
15.	Mandya	2	7	31	104	1,354	125	11	6
16.	Mysore	3	11	49	165	1,641	196	13	10
17.	Raichur	3	9	57	139	1,401	112	12	8
18.	Shimoga	2	9	52	172	1,793	184	13	7
19.	Tumkur	3	10	50	150	2,506	221	12	6
20.	Uttara Kannada	3	11	35	126	1,283	55	13	8
	State total	49	175	745	2,532	27,024	2,362	250	177

Source : Karnataka At A Glance, 1991-92, DES No. 70/1992, Directorate of Economics and Statistics, Bangalore.

(1981) and an area of 1,325 hectares and a population of 2,563 respectively are situated a few km beyond the actual borders of Belgaum district as enclaves in the land belonging to Kolhapur district. Another village Mukhed of Aurad taluk of Bidar district with an area of 702 ha and a population of 1,123 (1981) is in the midst of the land belonging to Osmanabad district of Maharashtra State. It is under the jurisdiction of Bidar district and rainfed area available for cultivation is about 575 hectares.

The State Government directed certain chages in the names/spellings of the names of the districts, taluks, towns, etc., against their mention in the Imperial Gazetteer. The details are indicated here, mentioning Imperial Gazetteer version and the new version together with the date when the change was made: 1. South Canara - Dakshina Kannada (1977), 2. Dharwar - Dharwad (1977), 3. Coorg - Kodagu (1977) 4. Mercara - Madikeri (1977) 5. North Canara - Uttara Kannada (1977) 6. Seringapatam - Shrirangapattana (1977) 7. Deodurga - Devadurga (1977) 8. Udipi - Udupi (1977) 9. Halibid - Halebidu and 10. Coondapur - Kundapur.

Add to Part I page 10 at the end:

The first sentence in IInd para may be read as the following: The total area of the State is 1,91,791 sq.km (and not 1,92,204 as mentioned in the previous edition).

Coastal Region

Add to Part I, Page 12, II Para:

The length of the coastline is about 300 km (not 400)

Add to Part I, page 30, before Earthquakes:

Ornamental Granites of Karnataka:

The most common and abundant varieties of rocks found in Karnataka include granites, gneisses, migmatite and dykes. About 92,000 sq.km (48% of the geographical area) is covered by granite and granitic rocks. Out of this, about 4,200 sq.km is estimated to be composed of granites of ornamental quality forming only a small fraction (2.2%) of the total geographical area. Exploitable granite deposits cover much less area (about one per cent). Common granite is a medium to coarse grained rock composed essentially of granular crystalline quartz, feldspar, minor amount of mica and ampibolite, magnetite, pyrite, zircon, apatite and sphene. There are many varieties of granites; varieties are decided on the basis of colour, texture and mineralogical composition. In some varieties, the interlocking minerals are uniformly distributed and they

are of same size. Certain granites, instead of being uniformly granular, show a distinctive pattern or texture due to the development of feldspar as conspicuous isolated crystals which are much larger than those of the granular ground mass in which they are embedded. Not all the granites occuring in nature are of ornamental quality. They must be free of blemishes such as criss-crossing veins, lines, fractures, close spaced joints, black, green or white patches or grains or spot of minerals or otherwise uniform rock.

In multicolour granites veins become an integral part of rock. Granites may occur in the form of wide-spread sheet prominently exposed above ground in the form of hills or hillocks, or just above ground level or sub-surface beneath a cover of soil. They may occur in the form of boulders of various size and shape either at the ground level or spread over sheet rocks as tors. Out of the total geographical area of 1,91,791 sq.km, only 8,947 sq.km area is covered by granite outcrops *i.e,* prominently exposed area constituting 4.66% of the total geographical area. The distribution of the different types of ornamental granites is as follows: (i) grey gneiss and migmatite (used locally as building material and as fencing slabs etc.,) varieties 4,685 sq.km, (ii) pink granites: 1,780 sq.km, (iii) grey granites: 1,080 sq.km, (iv) pink gneisses (multicolour granites): 562 sq.km, (v) granodiorite (darker variety of grey granites): 490 sq.km, (vi) red and grey syenites/felsites: 100 sq.km and (vii) dykes (black and green granites) 250 sq.km.

There are three main tracts of ornamental granites *viz.,* The eastern most tract, the central tract and the south western tract. Most of the ornamental varieties are restricted to the ten eastern districts of the State *viz.,* Mysore, Bangalore, Bangalore Rural, Mandya, Tumkur, Kolar, Chitradurga, Bellary, Raichur and parts of Bijapur districts. Next in importance are Hassan, Chikmagalur, Dakshina Kannada and Dharwad districts. The geographic and geological settings of the main types of ornamental granites are listed here.

Type of Ornamental granite	*Taluk in which they occur (in order of importance)*	*Geological settings*
Black granites (dykes)	Chamarajnagar, Yelandur Kollegal, Malavalli, T. Narasipur, Hunsur Periyapatna, Kanakapura, Gundlupet and Nanjangud	High grade metamorphic terrain of southern Karnataka

Type of Ornamental granite	*Taluk in which they occur (in order of importance)*	*Geological settings*
Green granites (dykes)	Belur, Chikmagalur, Kolar Hospet, Bellary, Chalkere, Tiptur, Nagamangala, Kunigal	Granite terrain north of the above settings.
Pink and red granites	Hungund, Kushtagi Magadi, Siruguppa, Bellary Koppal, Ramanagaram, Devadurga Shorapur and Lingasugur.	"Closepet granites"
Pink, pink-grey & pink green porphyritic granites	Devadurga, Magadi, Tumkur Koppal, Ramanagaram, Kolar, Gudibande, Bagepalli and Gauribidnur	"Closepet Granites" and Kolar type granitioids.
Multicoloured granites	Kanakapura, Channapatna Yelburga, Kunigal Malavalli, Tumkur, Kushtagi, Sandur, Maddur, Bangalore South and Lingasugur.	"Closepet Granite" and parts of peninsular gneiss
Grey granites	Sira, Chintamani, Bangalore South, Lingasugur, Nagamangala, Molakalmuru, Bellary, Chitradurga, Gangavathi and H.D.Kote.	Occurs as "Islands" in peninsular gneiss

Add to Part I Page 30:

Mineral Resources

Karnataka is endowed with fairly rich mineral wealth distributed more or less evenly over its territory. The State contains deposits of asbestos, bauxite, chromite, dolomite, gold, iron ore, kaolin, limestone, magnesite, manganese ore, ochre, quartz and silica sand. The tailings of gold form an important source of tungsten ore.

Amosite asbestos is produced in Hassan district. It occurs in Chikmagalur, Shimoga and Mandya districts also. Small deposits of anthophylite and chrysotile

are reported from Hassan and Mysore districts. Bauxite deposits are distributed in Belgaum, Chikmagalur, Chitradurga and Dakshina Kannada districts. Dakshina Kannada is the main producer of bauxite. Copper ore is mined in Chitradurga and Hassan districts. Small quantity of dolomite is produced in Bijapur and Tumkur districts. Mysore and Mandya districts have workable deposits of felsite. Fireclay is mainly produced in Hassan, Tumkur and Shimoga districts. Gold is mined in Kolar, Raichur and Gulbarga districts. Main iron ore producing districts are Bellary and Chikmagalur. Chikmagalur district covers Kudremukh and Gangamula quartz-magnesite deposits. Kudremukh Iron Ore Project is one of the biggest integrated mining complexes in the Country. Kaolin is produced in Belgaum, Shimoga, Hassan and Tumkur districts. Kyanite is worked in Mysore district. The State has extensive deposits of crystalline limestone. Flux grade limestone occurs in Bijapur, Belgaum and Chitradurga districts. Cement grade limestone deposits are confined to Bijapur, Chitradurga, Gulbarga, Mysore, Shimoga and Tumkur districts. The State is reckoned as the second largest producer of lime shell. Magnesite is produced in Mysore district. Manganese ore is produced in Belgaum, Bellary, Chitradurga, Uttara Kannada, Shimoga and Tumkur districts. Bellary is the main ochre producing district. Production of quartz comes from Bellary, Hassan, Shimoga and Tumkur districts. Fuchsite quartzite occurs in Bellary and Chikmagalur districts. Silica sand is produced in Dakshina Kannada district. Belgaum, Gulbarga and Chitradurga are the principal districts reporting output of moulding sand. Steatite is worked in Chikmagalur and Tumkur districts. Vermiculite occurs in Mysore district. Besides, production of black granite is reported from Mysore and Bangalore districts and pink granite is reported form Bellary, Raichur and Chitradurga districts.

The value of mineral production in Karnataka totalled Rs.200 crores in 1988, up by 27% relative to the preceding year. The State occupied 13th position accounting for 1.4% of the total value of mineral production in 1988. Gold, iron ore, limestone and manganese ore were the important minerals which together accounted for 87% of the value of mineral production in the State. Karnataka is the sole producer of felsite and leading producer of gold (84%), moulding sand (63%) and fuchsite quartzite (57%). The value of production of minor minerals was Rs.18 crores in 1988 and was higher by 123% compared to the preceding year. The number of reported mines in the State was 309 in 1988 as against 331 in 1987. The income from the mining and quarrying sector worked out to Rs.78.59 crores during 1986-87 and Rs.82.59

crores during 1987-88. The reserves of important minerals in the State and the production of major and minor minerals in the State from 1985 to 1989 are listed below:

The reserves of important minerals: (in million tonnes)

Mineral	*Recoverable reserves (as on 1-1-1985)*			
	Proven	*Probable*	*possible*	*Total*
Asbestos	-	0.14	0.11	0.25
Barytes ('000 tonnes)	-	-	9.00	9.00
Bauxite	1.26	10.49	15.25	27.00
Calcite ('000 tonnes)	-	14	13	27.00
Chinaclay	-	4.86	6.09	10.94
Chromite	0.46	0.14	0.80	1.40
Copper (i) Ore	1.27	3.77	-	5.04
(ii) Metal	0.008	0.024	-	0.032
Corundum	-	0.09	0.04	0.13
Dolomite	6.00	-	288	294
Feldspar	-	0.13	-	0.13
Fireclay	-	0.74	4.09	4.83
Fuller's earth (in situ)	-	0.49	0.97	1.46
Gold (in situ) (i) Ore	3.54	-	-	3.54
(ii) Metal (tonnes)	17.338	-	-	17.338
Gypsum	0.50	0.06	0.51	1.07
Iron (i) Hematite	193.82	9.09	110.42	313.33
(ii) Magnetite	1,292.13	230.80	-	1,522.93
Kyanite	0.12	0.31	0.20	0.63
Limestone	643.11	716.29	437.85	1,797.25
Magnesite	0.10	0.14	0.50	0.74
Manganese ore	1.59	14.16	57.26	73.31
Pyrite	-	-	2.40	2.40
Quartz and silica sand	2.26	2.42	24.53	29.21
Sillimanite (in situ)	-	-	0.08	0.08
Talc, Steatites & Soapstone	-	6.93	0.48	7.41
Titanium (in situ)	-	-	6.28	6.28
Tungsten (tonnes) (i) Ore	1,21,088	-	-	1,21,088
(ii)Contained W03	123	-	-	123
Vanadium (i) Ore	0.50	4.00	-	4.50
(ii) Metal (tonnes)	700	5,600	-	6,300
Vermiculite ('000 tonnes)	-	1	45	46

Besides, conditional (sub-marginal) resources of graphite are estimated at 18,000 tonnes and those of molybdenum around 1.321 million tonnes.

Table No. 1.2 Production of Major and Minor Minerals in Karnataka

Sl. No.	Mineral	Unit	Production 1985	1986	1987	1988	1989	1990
A:	**Major minerals**							
I.	**Metallic Minerals**							
1.	Bauxite	Tonnes	65,743	37,668	23,216	19,702	25,956	57,842
2.	Chromite	Tonnes	82,631	51,467	28,290	35,325	22,617	51,781
3.	Copper	Tonnes	51,348	66,731	58,210	39,257	82,788	1,01,489
4.	Gold	Kg	16,638	921	916	898	927	1,229
5.	Silver	Kg	62	43	42	49	11	52
6.	i) Iron ore	Tonnes	37,38,817	71,85,948	73,77,062	88,88,060	1,46,06,987	1,06,38,282
	ii) Iron ore fines	Tonnes	11,06,461	12,67,550	16,40,007	16,71,577	18,13,834	18,57,519
7.	Manganese Ore	Tonnes	2,74,183	2,76,196	2,65,443	2,14,701	2,90,355	4,76,548
	Sub Total		53,19,183	88,85,560	93,93,134	1,08,68,622	1,68,42,537	1,31,83,461
II.	**Non-metallic Minerals**							
1.	Asbestos	Tonnes	1,228	883	1,481	1,348	594	NA
2.	Black Clay	Tonnes	6,380	750	NA	NA	NA	NA
3.	China Clay	Tonnes	56,333	11,486	10,773	9,626	17,420	4,967
4.	Corundum	Kg	32	140	40	2	NA	81
5.	Dolomite	Tonnes	5,238	5,148	14,670	8,373	4,384	3,684
6.	Feldspar	Tonnes	2,303	1,159	2,010	1,772	1,304	213
7.	Felsite	Tonnes	1,140	1,260	1,308	1,373	1,260	10,095
8.	Fire clay	Tonnes	19,999	12,062	13,180	4,085	23,767	3,800
9.	Green quartz	Tonnes	72	96	150	126	152	1,15,522
10.	Kyanite	Tonnes	757	863	973	354	165	2,352
11.	Limeshell	Tonnes	61,662	58,744	63,386	53,814	53,363	84,357
12.	Limestone	Tonnes	29,74,634	44,71,702	84,53,704	53,42,954	52,76,216	64,44,292
13.	Magnesite	Tonnes	20,248	21,348	22,410	31,764	37,177	7,196

Table No. 1.2 Production of Major and Minor Minerals in Karnataka (Contd.)

Sl. No.	Mineral	Unit	Production 1985	1986	1987	1988	1989	1990
14.	Moulding sand	Tonnes	1,50,264	81,147	82,399	92,306	96,854	63,472
15.	Quartz	Tonnes	25,194	44,147	62,450	85,957	70,935	69,936
16.	Red ochre	Tonnes	173	220	413	1,420	482	316
17.	Red oxide	Tonnes	17,312	18,613	21,881	21,168	23,646	2,79,476
18.	Silica sand	Tonnes	79,088	85,807	1,20,554	1,21,736	1,12,222	97,608
19.	Shale	Tonnes	43,762	82,050	93,080	NA	NA	NA
20.	Steatite (Soapstone)	Tonnes	6295	5,712	3,700	1,908	2,001	2,535
21.	Vermiculite	Tonnes	495	505	NA	NA	NA	NA
22.	White clay	Tonnes	35	83,105	NA	NA	NA	NA
23.	Yellow clay	Tonnes	4239	2,852	752	1,664	1,561	NA
24.	Yellow ochre	Tonnes	90	112	952	NA	NA	NA
25.	Clay	Tonnes	NA	NA	NA	NA	NA	92,034
	Sub Total	Tonnes	34,70,941	49,89,871	89,70,266	57,81,748	57,23,503	72,81,855
	Total Major Minerals	Tonnes	87,90,124	1,38,75,431	1,83,63,400	1,66,50,370	2,25,66,040	2,04,65,316
B.	MINOR MINERALS							
1.	Building stone	Tonnes	13,87,341	13,48,738	7,01,703	6,82,540	12,07,438	8,79,228
2.	Brick earth	Tonnes	9,39,435	7,39,959	1,53,62,577	9,05,703	7,80,30,070	32,20,117
3.	Deccan trap	Tonnes	46,587	48,915	18,611	4,831	NA	NA
4.	Fullers earth	Tonnes	3,439	3,611	1,439	NA	4,006	4,431
5.	Lime kankar	Tonnes	6,970	5,452	4,225	4,436	450	1,720
6.	Lime stone (Shahabad stone)	Tonnes	1,04,292	1,224	7,92,890	48,948	3,06,814	54,70,257
7.	Murrum	Tonnes	800	NA	NA	NA	NA	75
8.	Ordinary clay	Tonnes	1,48,060	1,47,450	1,50,387	1,51,666	1,40,853	21,729
9.	Ordinary sand	Tonnes	2,21,981	3,02,293	1,38,331	99,200	1,57,876	1,35,249
10.	Ornamental stones	Tonnes	1,35,561	1,38,539	1,16,206	1,40,811	1,39,160	8,072*
11.	Laterite	Tonnes	18,938	12,618	18,079	8,905	8,903	5,076
12.	Red Earth	Tonnes	280	NA	NA	NA	NA	NA
	Total Minor Minerals	Tonnes	30,13,684	27,39,849	1,73,05,448	20,47,040	7,99,95,570	97,51,988+8072*

* Cubic Metres

Add to Part I, Page 35 Ground water potential:

Table No. 1.3 Status of Utilisation and Ground Water Potential in Karnataka

Sl. No.	*District*	*Total annual recharge ha.m*	*Net amount of recharge ha.m*	*Net annual Utilisation ha.m as on 1.1.1983*	*Percent Utilisation*	*Net annual Utilisation ha.m as on 1.1.1987*	*Percent Utilisation*	*Net annual utilisation ha.m as on 31.3.1991*	*Percent Utilisation*
1.	Bangalore	20,367	17,312	4,467	26	5,851	34	15,390	89
2.	Bangalore (R)	68,200	62,220	20,654	33	15,590	25	48,787	78
3.	Belgaum	1,18,403	1,00,642	27,641	27	35,690	35	65,000	65
4.	Bellary	86,795	73,776	8,412	11	14,316	19	20,992	28
5.	Bidar	51,021	43,368	7,069	16	10,537	24	20,070	46
6.	Bijapur	1,10,078	93,572	27,328	29	34,814	37	54,419	58
7.	Chikmagalur	76,807	65,287	1,811	3	6,224	10	6,640	10
8.	Chitradurga	70,388	59,830	14,718	25	19,785	33	34,246	57
9.	Dakshina Kannada	1,18,911	1,01,075	29,261	29	37,274	37	36,840	36
10.	Dharwad	1,24,882	1,06,150	88,344	8	16,488	16	30,937	29
11.	Gulbarga	1,05,485	98,096	7724	8	15,572	16	19,172	21
12.	Hassan	77,064	65,505	2,089	3	7,330	11	10,420	16
13.	Kodagu	35,652	30,304	377	1	2,133	7	1,920	6
14.	Kolar	60,129	51,110	28,976	57	32,912	64	69,289	94
15.	Mandya	74,889	63,741	5,608	9	10,707	17	15,012	24
16.	Mysore	1,20,137	1,02,116	9,286	9	17,002	17	28,954	28
17.	Raichur	1,04,682	88,981	6,175	7	13,408	15	20,727	23
18.	Shimoga	1,58,159	1,34,435	2308	2	13,067	10	11,466	9
19.	Tumkur	1,12,227	96,493	28,106	29	35,744	37	55,688	66
20.	Uttara Kannada	1,05,315	89,468	7,533	8	14,696	16	10,952	12
	State Total	17,99,591	15,42,481	247,887	16	3,69,140	23	5,76,921	37

Source: Department of Mines and Geology, Ground Water Cell, 1987.
Drought Monitoring Cell, Bangalore

Note : ha.m = hectare metre.

River Basins

Add to Part I, Page 39, after Ist Para:

Table No. 1.4 Major basins and their drainage areas in Karnataka

Sl.No.	*Major Basin*	*Area in sq.km*	*Sub-Basin*	*Area in sq.km*	*Districts*
1.	Krishna	1,13,271 (59)	Bhima	19,345 (10)	Belgaum, Bellary, Bidar
			Malaprabha		Bijapur, Chikmagalur,
			Ghataprabha	19,233 (10)	Chitradurga, Dharwad,
			Tungabhadra	37,786 (20)	Gulbarga, Hassan, Uttara
			Upper Krishna	17,685 (9)	Kannada, Raichur, Shimoga
			Vedavati	19,222 (10)	and Tumkur
2.	Cauvery	34,273 (18)	Arkavati	4,500 (2)	
			Hemavati	5,006 (2)	Bangalore, Chikmagalur,
			Kabini	5,160 (3)	Kodagu, Hassan, Mandya,
			Shimsha	7,810 (4)	Mysore and Tumkur.
			Suvarnavati	4,050 (2)	
3.	West Flowing rivers		Upper Cauvery	7,747 (4)	
			Kalinadi	9,291 (5)	Belgaum, Chikmagalur,
			Netravati	7,057 (4)	Kodagu, Dharwad, Hassan,
			Sharavati	5,540 (3)	Uttara Kannada, Shimoga
			Sita-Swarna	4,344 (2)	and Dakshina Kannada.
			Karanja	4,405 (2)	Bidar
4.	Godavari	4,405 (2)		2,826 (1)	Kolar
5.	Palar	2,826 (1)		7,146 (4)	Bangalore, Kolar and Tumkur
6.	Uttara Pinakini (Pennar)	7,146 (1)			
7.	Dakshina Pinakini (Ponnaiyar)	3,638 (2)		3,638 (2)	Bangalore, Kolar
	Total	1,91,791 (100)		1,91,791 (100)	

* Figures in brackets indicate area as percentage to the total area.

Add to Part I, Page 39, after Ist para:

Coverage of each sub-basins of the Krishna and the Cauvery

I.	CAUVERY BASIN	
C1.	Upper Cauvery	Entire catchment of the Cauvery and of all its tributaries above Krishnarajasagar dam.
C2.	Kabini	Entire catchment of the Kabini.
C3.	Suvarnavathi	Entire catchment of the Suvarnavathi.
C4.	Shimsha	Entire catchment of the Shimsha.
C5.	Arkavathi	Entire catchment of the Arkavathi plus the direct catchment of the Cauvery on its left, east of C4.
C6.	Middle Cauvery	Direct catchment of the Cauvery on both sides of the river between Krishnarajasagar dam and the beginning of the common border between Karnataka and Tamil Nadu, including the sub-catchment of the Lokapavani.
C7.	Palar	Entire catchment of the Uduthorehalla and of the Palar plus the direct catchment of the Cauvery on the right bank, east of the Palar catchment upto Mettur Dam.
C8.	Chinnar	Direct catchment of the Cauvery on the left bank between the beginning of the common border between Karnataka and Tamil Nadu and Mettur Dam including sub-catchments of the Doddahalla, the Chinnar and the Thoppair.
II.	KRISHNA BASIN	
K1.	Upper Krishna	The river Krishna from source to the confluence of the Dudhganga; the sub-basin includes the catchment area of the river Krishna and all its tributaries which fall in to the Krishna in this reach upto and including the Dudhganga.
K2.	Middle Krishna	The river Krishna, from its confluence with the Dudhganga to its confluence with the Bhima; the sub-basin includes the direct catchment of the Krishna in this reach as well as of all its tributaries out falling in this reach, except the Ghataprabha and the Malaprabha (K3 and K4 below).
K3.	Ghataprabha	The entire catchment of the Ghataprabha from

		source to its confluence with the Krishna, including the catchment areas of the Hiranyakeshi, the Markandeya and other tributaries of the Ghataprabha.
K4.	Malaprabha	The river Malaprabha from its source to its confluence with the Krishna; the sub-basin includes the entire catchment area of the Malaprabha and of all its tributaries.
K5.	Upper Bhima	The river Bhima, from its source to its confluence with the Sina; the sub-basin includes the catchment area of the Bhima in this reach as well as of all its tributaries which fall in to it including the Sina.
K5.	Lower Bhima	The lower part of the river Bhima from its confluence with the Bhima; the sub-basin includes the direct catchment of the Krishna in this reach and all of its tributaries which fall into it except the area covered by sub basins K8 and K9.
K8.	Tungabhadra	This sub-basin includes the entire catchment of the Tungabhadra and of all its tributaries, except that of the Vedavathi (K9).
K9.	Vedavathi	The river Vedavathi, from source to its outfall into the Tungabhadra; the sub-basin includes the catchment area of the Vedavathi (also called Hagari in its upper reach) and all its tributaries.

III. GODAVARI BASIN

Manjra Sub-basin	This basin includes the entire catchment of the Manjra from its source to its confluence with the Godavari including the catchment area of Manar and other tributaries of Manjra.

Add to Part I Page 55: List of Rivers and Streams:

I. Godavari Basin:

1. Manjra sub-basin include 12. Bhangurnala 13. Kareembadnala 14. Chitaguppinala.

II. Krishna Basin

I. Bhima sub-basin (upper and lower) Exclude No.7 Almel

Add to Part I Page 56:

II. Krishna Basin

III. Malaprabha sub-basin include 21. Gajendragadnala 22. Guledgudnala.

IV. Krishna sub-basin (upper, middle and lower) include 20. Hanumadoddinala 21. Ramadurganala 22. Yerndinala 23. Golepallinala

Add to Part I Page 57:

II. Cauvery sub-basin (middle) (read) (12) Madaput as Madapur and (33) Hebbahalla.

Add to Part I, Page 59:

V. West flowing rivers: include (55) Pandrinadi (56) Naginadi (57)Doginala

CLIMATE

Add to Part I, Page 61, after 3rd para:

For meteorological purposes, the State has been divided into three sub-divisions, viz (a) Coastal Karnataka consisting of Dakshina Kannada and Uttara Kannada districts, (b) North Interior Karnataka consisting of Belgaum, Bidar, Bijapur, Dharwad, Gulbarga and Raichur districts, and (c) South Interior Karnataka consisting of the districts of Bangalore Rural, Bangalore, Bellary, Chikmagalur, Chitradurga, Kodagu, Hassan, Kolar, Mysore, Mandya, Shimoga and Tumkur.

As per Koppen's classification, the State is covered by three main climatic types. The tropical monsoon climate covers the entire coastal belt and adjoining areas. The climate of this region is not with excessive rainfall during the monsoon season. Outside the coastal belt, the southern half of the State experiences hot, seasonally dry tropical savana climate while most of the northern half experiences hot, semi-arid, tropical steppe type of climate.

According to Thornthwaite's classification, the Coastal and Malnad regions are per-humid (moisture index 100% and above) and most of the Interior Karnataka semi-arid (moisture index of minus 66.7 to minus 33.3%) with moist sub-humid and dry sub-humid (moisture index of minus 33.3 to plus 20%) zones in between. The arid zone in the State is confined to east of Bellary district, most of Raichur district, east of Chitradurga district and the adjoining Pavagada taluk of Tumkur district with an additional small area in Bijapur

and adjoining north-east Belgaum district. Very dry areas with moisture indices of less than minus 60%, occur in Chitradurga, Bellary, Raichur and Bijapur districts, west and south Gulbarga district and north Tumkur district. Semi-arid regions with moisture indices of less than 50% occur in Bidar district in the north and the Bangalore district and adjoining areas of Tumkur and Mysore districts in the south. The sub-humid zone in the State exists as a narrow belt east of Western Ghats from Belgaum in the north to the west of Heggadadevanakote taluk of Mysore district in the south. Adjoining this in the west is a narrow strip of humid and a wider strip of per-humid zones. While the whole of Dakshina Kannada district falls in the per-humid, Belgaum, Shimoga, Chikmagalur and Hassan have all the climatic zones ranging from semi-arid to per humid. Belgaum has a small arid area also. About 77% of the total geographical area of the State covering Interior Karnataka, is arid or semi-arid with the State contributing 15% of the total semi-arid and three per cent of the total arid areas of the Country.

Rainfall Patterns

Add to Part I Page 69, after II para:

A detailed analysis of rainfall patterns in the State has been made (Krishnan, 1984) using the data for the period 1901 to 1980 and the results are summarised as follows:

Karnataka State receives 80% of the annual rainfall in the south-west monsoon period, 12% in the post-monsoon period, 7% in the summer and only one percent in winter. In the south-west monsoon period, the coastal region, on the windward side of the ghats, receives heavy orographic rainfall amounting to 3,350 mm annually, the northern coastal region getting slightly less rainfall than the southern coastal region. There is a rapid decrease in rainfall as the ghats are crossed, the average rainfall on the leeside being only 600-700 mm. The retreating or north-east monsoon current affects the eastern part of south Interior Karnataka and accounts for 30% of annual rainfall in this region, during the period October to December. The rainfall increases over and near the Western Ghats but decreases towards the West Coast.

There are two major rainfall deficit areas in the State with 500-600 mm of rainfall, both in north Interior Karnataka, one covering Bijapur, east Belgaum, north-east Dharwad and the west Raichur districts and the other east Bellary and Chitradurga district and a small portion of Tumkur district, the region with lowest rainfall of less than 500mm is around Challakere in Chitradurga district. Rainfall generally increases north and south of these deficit regions.

To the west, as the Western Ghats are approached, there is a sharp increase in rainfall, the annual rainfall in the sub-humid transitional zone being 700-1000mm., the increase continues westward to the humid to per humid *malnad* region, where the annual rainfall generally lies in the range 1,000 to 3,800mm. There are also some orographically favourable locations, where extremely heavy rainfall is recorded, such as Agumbe(8,276mm) in Thirthahally taluk of Shimoga district and Bhagamandala(6,032mm), Pulingoth(5,941mm) and Makutta(5,054mm) in the Kodagu district. The per-humid coastal zone of Dakshina Kannada and the western half of Uttara Kannada also receive more than 3,000 mm rainfall in the year. Two areas receive more than 4,000 mm rainfall, one around Karkala, Belthangady, Puttur and Bantwal and the other around Baindur. the heaviest for any plain station in India. The Karnataka coastal zone receives heaviest rainfall than any other part of the West Coast due to the large convergence in the monsoon westerlies that occur over this area and the fact that the Western Ghats are closest to the coast in this region.

Extreme Values of Annual Rainfall

A study of the heaviest rainfall, recorded in a year during the period 1901-1980 shows that at all stations in the arid and semi-arid regions of the State, annual rainfall exceeding 1,000 mm was recorded except in a few places such as Bellary, Kushtagi, Yelburga, Koppal, Hadagali, Gokak, Mundargi and Challakere taluks. Annual rainfall amounts exceeded 1,500 mm in the sub-humid areas of the transitional zone and at isolated locations around Jewargi and Yadgiri in Gulbarga district, Kollegal and Gundlupet in Mysore district and Nelamangala, Magadi and Ramanagaram in Bangalore Rural district. In the Malnad region, the highest recorded rainfall ranges from 2,000 to 6,000 mm. In the Western areas of Malnad from Yellapur to Madikeri, the highest recorded rain ranges from 5,469 to 5,929mm. In Uttara Kannada district except at Bhatkal and all the stations in Dakshina Kannada district, recorded extreme rainfall is more than 6,000 mm. The highest rainfall data recorded during 1901-1980 are 7,495mm in Baindur and 7,155 mm in Puttur. Stations in the Malnad region which receive extraordinarily heavy rainfall due to orography, such as Agumbe and Bhagamandala were not included in the above analysis.

A study of the lowest annual rainfall amounts recorded, shows that less than 200mm of rainfall was recorded in the very dry areas of Challakere, Pavagada, Mundargi and Bellary and in small area covering Jamkhandi, Biligi and Mudhol in Bijapur district. The lowest annual rainfall amounts recorded in the semi-arid zone lie within 200-400 mm except in some taluks in Bangalore Rural district and in the Bidar and Shahpur taluks. The minimum values exceeded 400 mm in the sub-humid transitional as well. Even in east Malnad

region minimum values less than 1,000 mm have been recorded. They exceed 2,000 mm in the region at places like Thirthahalli, Sringeri and Madikeri and the ghat regions to their West. In the coastal region, the minimum values exceed 2,000 mm in areas south of Kumta. In Belthangady and Karkala the minimum annual rainfall amounts of 3,310 mm and 3,079 mm recorded are the highest for the State. Special stations like Agumbe, Bhagamandala etc., were not included in the analysis.

Rainfall intensities are low in the semi-arid regions and less than 140 mm in the central Dharwad district, a strip covering Chikmagalur, Kadur, Arsikere, Sira, Hiriyur and Pavagada, northwest of Mysore district and adjoining Mandya district. Daily rainfall intensities range from 180 to 240 mm in north Bijapur, north Gulbarga and Bidar district. Similarly south Mysore, south Tumkur and the adjoining parts of Mandya district, south Bangalore and south Kolar district have higher rainfall intensities ranging from 180 to 250 mm. In Chitradurga district, Harihara, Chitradurga, Challakere and Molkalmuru as well as in Sirguppa in Bellary district, the daily rainfall intensities vary from 180 to 200 mm. In east Malnad region, it ranges from 200-330 mm, while in the West Malnad and the per-humid coastal regions, rainfall intensities (heaviest rainfall) recorded so far in 24 hours, are at Bhagamandala (842mm, 1924 July 25), Agumbe(563 mm, 1922 July 23) and Kumta 580 mm, (1966 July 30).

Districtwise monthly, seasonal and annual normal rainfall (mm) based on data from 1901-1970 for taluk headquarter stations are given in table no 1.5, Normal and annual average rainfall data (in mm) by districts for the period from 1971-1991 are given in table no. 1.6

FAUNA

Add to part I, Page 99 after IInd para:

Karnataka is one of the five major States that share the biological wealth of Western Ghats. About 50 percent of the amphibian fauna of the Western Ghats are known from Karnataka alone. There are 58 species of amphibians reported from the State. Karnataka as a State stands next only to Kerala in its wealth of amphibian species. The Malabar torrent toad (*Ansonia ornata*) is restricted to the forests of Kodagu and Dakshina Kannada and it has not been discovered elsewhere in the past 100 years. The tadpoles of this colourful toad are found in clear, torrential streams clinging to the slimy rocks against the water current. The frog species namely *Micrixalus saxicola* is common in a few streams in the hills of Chikmagalur and Dakshina Kannada. This species was first known from Kerala and no where considered common. Frogs

in the genera *Ranixalus, Nannobatrachus* and *Nictibatrachus* are endemic to the Western Ghats. *Ranixalus gundia* is exclusive to Karnataka. *Nannobatrachus kempholeyensis* is known only from Hassan. Out of the eight species (of *Nictibatrachus* genera) discovered so far five occur in Karnataka *Nictibatrachus humayuni* was reported from Uttara Kannada-Goa forests.

A list of amphibians known from Karnataka are given here:

(1) Bufonidae family:i) *Ansonia* genera - *Ansonia ornata*; ii) Bufo genera - *Bufo brevirostrix, B.fergusoni, B.hololius, B.melanostictos, B.microtymbanum, B.parietalis* and *B.stomaticus.*

(2) Microhylidae Family: i)*Kaloula* genera - *Kaloula pulchra* ii)*Microhyla* genera - *Microhyla pulchra, M. ornata*; iii) *Ramanella* genera - *Ramanella minor, R.mormorata* and *R.triangularis* and *R.variegata*; iv)*Uperodon* genera - *Uperidon globulosum, U.systema*

3) Ranidae Family: i)*Micrixalus genera - Micrixalus saxicola,* ii)*Nannobatrachus* genera - *Nannobatrachus kempholeyensis,* iii) *Nictibatrachus* genera - *Nictibatrachus aliciae, N.humayuni, N.major, N.sanctipalustris* and *N.sylvaticus,* iv)*Rana* genera: *Rana aurantiaca(bhagmandlensis), R.beddomi, R.curtipes, R.cyanophlyctis, R. hexadactyla, R.intermedius, R.leithii, R.keralensis(verrucosa) R.limnocharis, R. malabarica, R.sauriceps, R. temporalis, R.tenuilingula and R.tigerina,* v) *Ranixalus* genera - *Ranixalus gundia,* vi)*Tomopterna* genera - *Temopterna breviceps, T.debsonii* and *T.leucorhynchus.*

(4) Rhacophoridae family: i)*Philautus* genera - *Pilautus charius, P.erni, P.elegans P. femoralis, P.hassanensis, P. Kottigeharensis, P. longierus, P. melanensis, P.montanus, P.narainensis, P. swamianus and P. temporalis*; ii) *Polypedates* genera - *Polypedates maculatus and P. caruciger*; iii) *Rhacophorus* genera - *Rhacophorus malabaricus.*

(5) Icythyophidae family; i)I*chthyophis* genera - *Ichthyophis beddomi.*

Source: Karnataka state Environment Report V p-79-85.

FLORA

Add to Part I page 69, after II para:

Coastal Vegetation

Coastal Vegetation constitute a distinct soil vegetation type and it is categorised into two subtypes *viz.*, Estuarine border land vegetation and Strand vegetation.

Estuarine Border Land Vegetation: This sub-type is characterized by mangrove formations, chiefly influenced by estuarine setting. Mangroves are the salt tolerant coastal plants found in the vicinity of intertidal and brackish water habitats. They occupy the interfaces between the sea and land. Mangroves help in preventing various kinds of levels of losses from floods and erosion of economically important agricultural fields, garden lands and estuarine shores. They support the growth of most useful marine algae species and naturally supports other rich marine Flora and Fauna. Presence of Mangroves also stabilizes the shores and breaks to a large extent the erosive ferocity of winds and tidal wave action.

Mangroves in Karnataka, are fringing type, found in the inter tidal region along with estuaries, backwater, islands and other protected areas. The present estimates of existing and prospective mangroves in Dakshina Kannada district are approximately 5,000 hectares and Uttara Kannada about 3,000 hectares. The principal estuaries of the sea board are Netravathi Gurpur estuary, Mulki-Pavanje estuary, Udyavara Pangala estuary, Swarna-Sita-Kodi estuary, Chakra Haladi-Kollur estuary, Baindur Hole estuary, and the Shiroor hole estuary of the Dakshina Kannada district. The tidal rivers of the Uttara Kannada district are Kalinadi, Bedthi or Gangavali, Aghanashini or the Tadri, Sharavathi, Venkatapur, and the tidal rivulets are the Belekeri, Ankola, Gorgadde halla and the Bhatkal or Sharabi.

The main assoies or associations of mangroves are as follows : (a) *Rhizophora mucronata* consocies : This habitat is inundated for less than four in every 12 hours by the average tides. The area is a narrow strip parallel to flowing river or to lagoon banks. *Rhizopora mucronata* grows to a height of upto 25 metres with multiple branches spreading over the area and produces elaborate network of interlocking stilt roots; (b) *Rhizophora-Bruguiera* association: with the process of reduced accretion due to occasional inundation with above average high tides, there is a change in the Flora into *Rhizophora-Bruguiera* association. Much of the lagoon banks and around the estuarine islands, particularly raised reliefs are encountered with this association. The individual trees are straight and attain a good height and show dense crown of leaves on the branches. *Bruguiera,* being a shade tolerant, grows quite well between and below the crown shadow of *Rhizophora.* On slightly higher relief, the fern *Acrostichum aureum,* the scrubby *Acanthus ilicifolius* and *Clerodendron inerme* occur sporadically; (c) *Avicennia marina* consocies : on the banks of tidal rivers near the sea where clay is dominant, *Avicennia marina* is found in abundance. They have not attained a good tree height in the estuarine complex of the State coast. They are very much stunted and gnarled apparently due

to constant collection of leaves as fodder; (d) *Avicennia-Sonneratia* association : this association is not uncommon on sandy clay relief. Both the plants are in good formation, and they are being axed for fuel by the local people. Although large trees of *Avincennia alba* are there, no generation was observed. Howèver the tangled undergrowth of *Clerodendron inerme, Acanthus ilifolius* and *Acrostichum aureum* are found in profusion; (e) *Kandelia-Excoecaria* association: as the salinity level of the stream is reduced and the land raise slowly *Kandelia* formation is a common sight; similarly *Excoacaria* assumes local dominance on the banks to the exclusion of the tree forms of *Kandelia.* Along the banks, especially in the side channels there are smaller trees composed of *Cerbia, Sonnerata* and *Morinda.* The only climber on the Mangrove taxa lining the tidal river banks is *Derris trifoliata*; (f) *Aegiceras-Excoecaria* association: this association is very common towards the landward margin of the estuarine banks. Low lying island reliefs are often covered with *Canthus illifolius* formation almost to the exclusion of other Mangrove taxa; (g) *Acrostichum-Acanthus* association: the chief component of the secondary formation is that of *Acrostichum aureum* often mixed up with *Acanthus ilifolius* or *Clerodendron inerme.*

Mangroves in Karnataka coast grow well on silty and clayey muds or mixtures of these soils. The fringing mangroves type is the dominant and stable type along the estuarine bank of the State and their discontinuity is due to the large scale wood cutting or reclamation for agricultural operations. In Karnataka the estuarine banks are divisible into three zones in respect to tidal levels. The first zone is an acquatic marginal area of the down slope more or less exposed under low tide. This zone is very limited in breadth, more or less free from plants except the saline grass, *Porteresia coractata.* The absence of *Aeluropus lagopoides* a saline grass along the Karnataka coastal settings is very common. The next zone is inter-tidal zone covered with the assemblage of a few tidal mangroves. This zone has limited width, mostly due to alogenic causes and the result is the formation of linear pattern of mangrove formation mostly represented by *Rhizopora mucronata.* If a width is considerable then other mangroves like *Ceriops decandra, Bruguiera gymnorrhiza* and *Bruguiera cylindrica* are also seen. The width of this zone is limited due to heavy agricultural operations up to the landward margin of this zone. This zone is succeeded by Supra tidal zone. The presence of this zone is rather a rare feature in the State's coast due to the prevailing agricultural operations. However in certain places where they are present, they are found occupied by shrubby *Acanthus ilifolius, Clerodendron or Excoecaria agallocha* almost to the exclusion of Euman groves. Apart from the fringing mangroves along the banks, there are certain mangrove formations confined

to distinct topographical situations, such as mid-stream estuarine islands, mud-flats and depressions or basins of shallow relief where zonal pattern of plants can be seen. Any change in the depth and the quality of water regime specially in low lying relief, leads to change in the assemblage of mangrove taxa.

Strand Vegetation: Strand vegetation or Beach vegetation is one of interesting formations of many coastal areas. The term strand is used in the sense that strip of land close to the shore and its inland sand ridges dunes. The climate of the beach areas from Mangalore to Karwar are categorised under sub-humid category. The strand vegetation is very much influenced primarily by the environmental factors such as tides, tidal action and salt spray or salinity. Along the beaches there are distinct coastal plants when compared to adjacent sub-coastal inland Flora. The growth of a few plants showing fidelity to the marine strand such *Ipomoea pes-capracea, Canavalia rosea, Spinifex littoreus, Hydrophylax maritima, Launaea sarmentosa, Cyperus peduoculatus, Scaevola sericea, Scaevola plumerii* and *Flagellaria indica* could be considered as unique to this habitat. They as a group are designated as 'psammophytes'. The strand flora is considerably disturbed and altered to a greater extent. However there are good number of patches composed of creepers like *Ipomoea pes-caprae* associes or *Ipomoea-Canavalia* association or *Ipomoea-Launaea* association of *Cyperus-pedunculatus* associes or *Cyperus-Launaea* association or *Cyperus-Hydrophyla -Cyperus* association or associes of *Crotalaria nana* or *Euphorbia atoto* or *Scaveola serices.* Towards the landward area of the beaches there are shrubs or trees composed of *Calophyllum inophyllum, Clerodendrum inerne, Morinda citrifolia, Pandanus odoratissmus, Premna serratifolia, Scaveola serices* and *Thespesia populnea.* The most conspicuous *Salvadora persica* formation found only around coconut island(St. Mary Islands) near Udupi along the backshore and also in a few patches along the Aghanashini riverine bank in the vicinity of Sanikatta, (Uttara Kannada). The sandy relief with excess of salinity are almost absent along the Karnataka coast. This has resulted in the absence of 'Euhaline' zone with its representative like *Salicormia, atriplex, Arthocenemum, Suaeda* etc.

In undisturbed landward margins of the beaches, a few tree forms like *Borassus flabellifer, Calophyllum inophyllum Heritiera littoralis, Hibiscus tiliaceus, Morinda citrifolia, Pandanus odoratissimus, Pongamia glabra, Terminala catappa* and *Thespesia populnea* are observed in groups of three to five on an average. Beyond this sandy relief, there are extensive cultivation of coconut, cashewnut and other commercial crops. Along the Karnataka coast, strand coral is not present. Strand rock mostly in the form of thrownout boulders covered with marine algae is the dominant feature of all the beaches and it is restricted at few places.

Add to Part I, page 122, before Forest:

List of all endangered species of Karnataka State

Name of species	*Family*	*District where the species are available.*
I. Apparently Extinct species:		
1. Ceropegia fantastica Sedgw.	Asclepia	U. Kannada
2. Begonia canarana Miq.	Bigoniaceae	D. Kannada
3. Hubbardia heptaneuron Bor.	Poaceae	U. Kannada
4. Madhuca insignis (Radik) J.J. Smith	Saptotaceae	D. Kannada
5. Uphiorhiza burnonis	Rubiaceae	No collection after 1916-known from Kerala and Karnataka.
6. Salacia malabarica Samble	Asteraceae	No collection after 1916 - known from Kerala and Karnataka.
II. Endanged Species:		
1. Euonymus anulatus Wight.	Celastraceae	Kodagu
2. Crotalaria Sandoorehsis Bedd. ex Gamble	Fabaceae	Bellary
3. Iphigenia sahyadrica Ansari et Rolla	Liliceae	U.Kannada, Shimoga
III. Vulnerable Species:		
1. Aglaia talboti Raghavan		U. Kannada, Shimoga
2. Bullbophyllum elegantulum (Rodlk) J.J.Smith	Orchidaceae	Kodagu
3. Ceropegia fimbriifera	Asclepiadaceae	Known from T.N. and Karnataka
4. Cynometra burdillonii	Fabaceae	Dakshina Kannada, Hassan
5. Isonandra stockisii C.B. Clarke	Sapotaceae	Hassan
6. Neanotis prainiana (Talbot) Lewis	Rubiaceae	Hassan
7. Paracautleya bhatii R.M.Smith	Zingiberaceae	Dakshina Kannada
8. Tarenna agubensis	Rubiaceae	Chikmagalur, Hassan, Shimoga, D.Kannada.

continued on P.30

Table No. 1.5 Districtwise monthly, Seasonal & Annual Rainfall (MMs) Based on I.M.D. Data (1901-70) for Taluk Headquarters Stations.

Sl.No.	District	Taluks	Jan	Feb	Mar	Apr	May	Total(PM)	Jun	Jul	Aug	Sep	Total(SW)	Oct	Nov	Dec	Total (NE)	Annual
1.	Bangalore	3	4.7	7.7	7.5	41.9	115.9	177.7	68.9	99.4	122.7	148.7	439.6	168.2	64.3	16.9	249.4	866.8
2.	Bangalore Rural	8	4.3	6.0	8.1	42.1	107.4	167.8	68.2	84.0	111.9	151.2	415.3	157.5	62.6	13.4	233.5	816.6
3.	Kolar	11	6.9	5.8	9.0	33.4	80.3	135.4	61.0	80.8	100.1	145.4	387.3	135.8	68.6	16.8	221.2	743.9
4.	Tumkur	10	3.1	4.1	6.1	33.6	90.9	137.8	60.7	68.9	85.0	127.7	342.2	141.9	56.4	10.1	208.4	688.4
5.	Chitradurga	9	3.0	3.9	4.0	27.1	75.7	113.7	52.7	67.6	68.9	100.7	289.8	121.0	44.1	11.2	176.2	579.8
6.	Shimoga	9	1.7	2.2	10.4	42.9	86.7	143.9	253.8	558.3	293.3	121.7	1227.1	142.2	45.2	10.1	197.6	1568.6
BANGALORE DIVISION		50	4.0	4.6	7.6	35.9	89.2	141.2	95.8	163.6	129.5	130.7	519.5	140.9	56.3	12.7	210.0	870.7
7.	Mysore	11	3.8	5.2	12.0	66.0	139.1	226.1	58.7	82.5	73.0	92.9	307.1	155.7	66.4	15.5	237.7	770.9
8.	Mandya	7	2.8	5.3	7.9	50.2	123.0	189.1	43.9	44.8	64.2	111.5	264.5	169.5	62.0	14.7	246.2	699.9
9.	Hassan	8	3.5	4.3	8.0	59.3	109.4	184.6	118.2	250.3	138.8	97.6	604.9	161.3	65.1	15.3	241.7	1031.2
10.	Chikmagalur	7	3.1	3.5	9.2	55.3	101.9	172.9	300.4	671.7	382.1	160.0	1514.1	163.5	59.0	15.7	238.2	1925.2
11.	D.Kannada	8	4.3	2.2	8.4	43.5	171.2	229.6	983.3	1316.4	803.9	344.4	3448.0	244.6	88.1	18.9	351.5	4029.1
12.	Kodagu	3	5.0	5.6	14.7	73.5	146.7	245.5	486.0	938.3	529.3	218.9	2172.6	201.7	79.9	18.7	300.0	2718.2
MYSORE DIVISION		44	3.6	4.3	9.7	57.0	131.6	206.2	302.9	483.5	296.7	161.7	1244.8	179.4	69.1	16.2	264.8	1715.7
13.	Bellary	8	1.8	3.2	4.0	28.8	64.6	102.4	67.5	86.9	94.5	138.9	387.8	106.3	33.3	9.0	148.6	638.6
14.	Raichur	9	0.9	1.1	3.9	19.7	41.2	66.8	68.7	96.5	102.9	145.0	413.1	90.9	21.6	6.7	119.2	599.2
15.	Gulbarga	10	2.7	3.9	9.6	18.6	33.0	67.8	108.3	161.3	143.8	193.4	606.8	80.8	16.1	5.2	102.1	776.5
16.	Bidar	5	3.5	5.7	11.2	21.2	23.4	65.0	131.4	189.9	179.5	191.8	692.6	65.0	18.7	6.0	89.7	847.3
GULBARGA DIVISION		32	2.1	3.2	6.8	21.9	41.7	75.7	90.6	128.9	125.6	165.9	511.0	87.5	22.4	6.7	116.6	703.2
17.	Belgaum	10	2.0	1.5	7.6	32.9	65.2	109.2	103.7	205.1	122.3	109.7	540.8	111.3	38.3	8.8	158.3	808.3
18.	Bijapur	11	2.4	3.3	5.6	21.5	42.3	75.2	71.1	75.5	71.6	148.3	366.5	88.5	31.0	7.9	127.5	569.1
19.	U.Kannada	11	1.2	1.1	4.0	28.2	103.1	137.6	680.4	1005.9	554.3	248.4	2488.9	148.1	48.6	12.3	208.9	2835.5
20.	Dharwad	17	1.4	2.4	5.2	39.8	77.8	126.7	87.9	135.4	92.3	105.9	421.5	119.8	39.2	10.0	169.0	717.2
BELGAUM DIVISION		49	1.7	2.1	5.5	31.7	72.9	114.0	220.4	331.6	197.5	148.2	897.6	117.4	39.3	9.8	166.5	1178.1
STATE AVERAGE		175	2.9	3.6	7.4	37.5	86.6	138.0	181.8	284.7	189.9	149.8	806.2	134.3	48.6	11.7	194.5	1138.6

Source: Drought Monitoring cell, DST, Bangalore.

Note: MM=Milli Metres, PM = Pre Monsoon, SW= South West monsoon NE = North East monsoon.

Table No. 1.6 Normal and Actual Average Rainfall (mm) by Districts 1971-1991 (cont'd)

Division District	Normal Rainfall	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Bangalore Division												
1. Bangalore	867	991	948	1043	916	1375	674	1069	943	1050	739	940
2. Bangalore rural	817	.....						N A				.....
3. Chitradurga	580	512	616	533	615	790	275	697	595	611	615	604
4. Kolar	744	693	831	794	836	973	623	806	812	904	581	850
5. Shimoga	1569	1224	1224	1362	1239	1688	906	1319	1874	1479	2055	1481
6. Tumkur	688	686	822	754	793	1043	407	970	712	865	812	913
Belgaum Division												
7. Belgaum	808	668	652	788	891	1064	667	863	820	937	752	940
8. Bijapur	569	610	356	668	732	913	399	708	755	712	439	843
9. Dharwad	717	694	633	690	843	902	554	737	901	1028	921	703
10. Uttara Kannada	2835	2434	2224	2676	2978	3631	2575	2774	3121	2470	3095	2783
Gulbarga Division												
11. Bellary	639	476	448	732	706	916	337	625	714	620	521	727
12. Bidar	847	674	628	902	707	1341	843	631	1212	948	771	1033
13. Gulbarga	777	442	461	1042	1014	1102	977	967	1126	1019	788	1160
14. Raichur	599	565	442	632	979	1245	498	743	784	669	489	722
Mysore Division												
15. Chikmagalur	1925	1898	1754	1862	1754	2222	1536	1892	2395	2087	2618	1941
16. Dakshina Kannada	4029	4514	3583	3968	4467	5496	3530	4103	4880	3477	4339	4317
17. Hassan	1031	821	1133	1071	799	1167	693	1298	1218	1141	1176	957
18. Kodagu	2718	2468	2363	2560	2640	3165	2102	3094	3013	2654	3110	3026
19. Mandya	700	776	870	655	615	853	413	935	823	838	618	818
20. Mysore	771	906	980	775	635	882	552	1027	844	1008	733	932
Karnataka State	1139	1280	1220	1343	1407	1746	1067	1479	1563	1431	1509	1497

Source: Directorate of Economics and Statistics, Bangalore

Table No. 1.6 Normal and Actual Average Rainfall (mm) by Districts 1971-1991

Division / District	Normal Rainfall	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Bangalore Division											
1. Bangalore	867	549	869	692	519	924	715	853	576	557	1377
2. Bangalore rural	817		----------	N A	----------		889	923	569	570	1210
3. Chitradurga	580	544	514	576	409	658	609	684	494	492	706
4. Kolar	744	555	671	666	494	697	689	843	653	633	1027
5. Shimoga	1569	1750	1540	1402	1075	1526	1146	1370	1444	1445	1668
6. Tumkur	688	562	641	711	550	773	869	954	523	550	911
Belgaum Division											
7. Belgaum	808	764	773	635	536	597	658	786	598	596	959
8. Bijapur	569	568	544	498	421	518	758	618	493	490	645
9. Dharwad	717	801	675	643	496	735	754	748	500	500	902
10. Uttara Kannada	2835	3057	3147	2597	2327	2089	2432	3147	3213	3277	2764
Gulbarga Division											
11. Bellary	639	594	647	543	391	665	779	764	646	644	637
12. Bidar	847	912	1081	712	785	702	836	1089	1240	1181	678
13. Gulbarga	777	991	1426	830	666	784	795	1008	1016	982	657
14. Raichur	599	618	727	404	558	608	738	631	655	643	623
Mysore Division											
15. Chikmagalur	1925	1856	1841	1893	1524	1834	1295	1551	1825	1823	2004
16. Dakshina Kannada	4029	4309	4229	3515	2995	3368	2872	3595	4312	4296	4022
17. Hassan	1031	746	908	1202	635	979	881	794	688	686	1272
18. Kodagu	2718	2208	2422	3076	2332	2294	1780	2240	2361	2367	2626
19. Mandya	700	427	747	665	439	858	886	765	387	368	882
20. Mysore	771	522	798	737	579	707	858	848	441	436	901
Karnataka State	1139	1268	1363	1332	1050	1208	1042	1287	1046	1095	1252

Table No. 1.7 Mean Maximum and Minimum Temperature at selected observatories in Karnataka, 1975-1987 (cont'd)

Division / Distrct	Location of the Observatories	1975		1976		1977		1978		1979		1980		1981		1982		1983		1984		1985		1986		1987	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Bangalore Division																											
1. Bangalore	1. Bangalore C.O.	28.6	18.6	29.2	18.6	29.0	18.8	28.6	19.0	29.3	19.4	29.6	19.0	29.3	18.4	29.7	19.0	30.3	19.4	28.9	18.8	29.6	18.9	29.4	19.1	29.9	19.5
	2. Bangalore HAL	29.2	17.6	29.8	17.4	29.5	18.0	29.3	18.1	29.8	18.2	29.8	17.7	28.9	18.0	29.3	18.3	29.7	18.5	28.5	18.0	29.3	18.2	29.2	18.6	NA	NA
	3. Yelahanka IAF	29.0	18.1	23.3	19.0	29.4	19.6	29.1	18.6	29.6	18.8	30.4	18.4	29.4	18.6	29.7	18.4	30.4	18.9	29.2	18.4	29.7	18.4	29.9	19.6	29.9	18.7
2. Chitradurga	1. Chitradurga	30.0	19.6	30.9	19.8	30.8	20.0	29.1	20.3	30.8	20.6	30.7	20.5	30.6	16.9	30.9	20.5	30.9	20.5	30.4	20.2	30.9	20.2	30.9	12.3	28.4	20.5
3. Kolar	1. K.G.F.	28.9	18.2	29.7	18.3	29.1	18.5	28.9	18.7	29.4	19.0	30.0	18.6	30.7	18.3	29.7	19.1	29.9	19.6	29.6	18.8	29.2	17.2	28.7	19.0	NA	NA
4. Shimoga	1. Agumbe	27.5	15.6	28.1	15.1	28.4	15.9	28.1	15.0	28.9	14.6	27.5	15.4	28.0	14.5	28.8	14.6	30.3	12.3	28.9	14.2	28.2	15.7	28.7	15.5	NA	NA
	2. Shimoga	30.5	19.7	30.9	20.4	30.7	19.8	30.2	19.8	30.9	20.5	30.8	19.8	28.4	19.8	NA	NA	30.7	22.2	30.1	NA	32.2	20.3	28.7	15.5	NA	NA
5. Tumkur	1. Tumkur	29.9	19.4	29.1	17.9	29.9	19.6	29.5	19.8	30.1	20.2	30.1	19.9	29.8	20.0	30.5	20.0	30.9	19.7	19.6	19.4	30.4	19.6	30.2	19.6	NA	NA
Belgaum Division																											
6. Belgaum	1. Belgaum City	30.3	18.2	31.1	18.8	30.6	18.9	30.0	18.8	30.0	18.8	30.8	18.9	30.8	17.8	30.2	20.6	30.7	19.1	30.1	19.0	30.8	18.7	30.8	19.1	NA	NA
	2. Sambre	29.2	18.5	29.8	18.5	29.7	18.6	29.4	18.7	29.8	18.9	30.2	18.8	29.8	18.5	29.3	18.7	30.4	18.3	30.1	18.6	30.3	18.9	30.4	18.6	30.4	16.8
7. Bijapur	1. Bijapur	32.3	20.1	33.2	20.7	32.9	20.9	32.5	20.9	33.0	21.3	33.0	21.3	32.4	20.7	33.0	21.0	33.2	20.6	33.1	20.8	36.2	20.8	33.7	20.5	NA	NA
8. Dharwad	1. Gadag	30.6	19.6	31.1	19.3	31.4	19.8	30.9	20.1	31.9	20.3	31.7	20.3	31.1	20.8	31.3	20.0	31.5	19.9	31.5	20.1	32.0	20.0	31.8	18.8	30.9	18.5
9. Uttar Kannada	1.Honnavar	30.8	22.7	31.5	23.5	32.4	23.4	31.1	23.1	31.2	23.5	31.3	23.3	31.5	23.2	30.6	23.1	31.3	22.9	31.8	23.5	31.8	23.2	31.7	23.6	NA	NA
	2. Karwar	31.0	22.0	31.9	21.8	32.3	22.8	30.3	22.7	30.7	22.8	31.0	23.0	30.9	22.4	30.4	22.4	31.0	22.2	31.4	22.9	31.5	22.4	31.5	23.1	NA	NA
	3. Shirali	NA	NA	NA	NA	NA	NA	NA	NA	31.3	23.5	25.7	21.4	31.2	23.6	31.2	23.7	31.6	24.1	32.0	23.3	32.4	23.5	32.4	23.2	NA	NA

Table No. 1.7 Mean Maximum and Minimum Temperature at selected observatories in Karnataka, 1975-1987

Division / District	Location of the Observatories	1975		1976		1977		1978		1979		1980		1981		1982		1983		1984		1985		1986		1987	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Gulbaraga Division																											
10. Bellary	1. Bellary	32.6	22.6	33.7	21.3	33.6	21.2	33.3	20.4	34.0	20.8	34.2	21.3	33.1	20.8	34.2	21.2	34.4	22.0	34.1	19.7	34.6	20.7	33.8	22.0	34.0	34.0
11. Bidar	1. Bidar M	30.5	20.4	38.4	19.1	31.3	21.0	30.7	20.6	31.6	21.7	31.5	21.3	30.9	20.8	31.1	21.1	30.9	20.7	31.8	20.7	31.9	20.6	32.2	20.9	NA	NA
	2. Bidar IAF	31.2	19.3	32.5	20.2	32.3	19.2	31.3	49.3	32.1	19.1	32.3	20.6	31.7	20.0	32.1	19.9	32.1	19.3	31.9	18.6	31.9	18.2	32.3	18.8	NA	NA
12. Gulbarga	1. Gulbarga	33.0	20.5	33.3	20.9	33.2	21.2	32.8	21.4	33.7	21.8	34.0	22.0	33.5	22.7	33.7	21.7	33.7	21.5	33.1	21.5	34.1	21.4	34.1	21.7	NA	NA
	2. Raichur	31.6	19.2	33.4	20.9	33.8	20.2	33.2	21.0	33.5	21.1	33.7	20.7	33.3	21.6	33.8	22.1	33.3	21.2	33.6	21.6	33.9	20.9	34.0	19.7	34.1	17.9
Mysore Division																											
13. Chikmagalur	1. Balehonnur	28.2	16.0	29.3	17.0	28.9	18.0	30.0	16.3	29.6	15.8	29.7	14.1	27.2	13.1	29.7	12.0	29.4	17.1	28.4	17.9	28.5	17.9	29.0	18.2	NA	NA
	2. Chikmagalur	27.0	17.3	27.7	17.6	27.5	18.0	27.1	17.8	27.9	18.0	27.6	17.8	20.1	12.8	28.6	18.0	28.7	17.8	28.2	17.4	28.2	16.9	28.3	17.6	NA	NA
14. Dakshina Kannada	1. Bajpe	30.8	22.5	31.4	22.8	31.4	23.2	31.1	22.9	31.8	23.3	31.6	23.0	31.7	25.0	38.2	22.9	31.5	22.8	31.6	23.2	31.7	23.1	31.6	23.4	NA	NA
	2. Mangalore IAF	30.5	24.4	30.9	23.9	31.5	23.9	31.3	23.3	31.4	24.3	31.2	23.7	30.2	23.9	Observation closed during 1982											
	3. Panambur MHP	30.4	23.0	31.1	22.5	31.0	23.6	30.7	23.2	31.2	23.6	31.2	23.3	30.8	22.9	30.6	21.9	30.8	22.4	31.0	23.3	31.0	22.9	30.9	23.2	NA	NA
15. Hassan	1. Hassan	27.3	16.1	28.7	15.0	28.6	13.4	28.3	15.5	29.3	15.6	NA	NA	36.6	17.4	26.7	14.9	27.0	16.1	28.0	18.2	28.8	18.1	28.6	18.4	28.8	17.9
16. Kodagu	1. Madikeri	25.0	16.5	29.1	16.4	25.6	17.5	26.7	17.5	25.6	17.0	24.8	17.2	23.1	16.2	25.7	17.1	26.0	17.3	25.1	16.7	25.8	15.5	24.4	15.8	24.0	14.5
17. Mandya	1. Mandya	30.7	21.3	31.0	18.4	30.6	19.4	30.3	19.8	NA	NA	30.7	19.2	30.7	17.0	31.1	16.5	32.2	17.0	31.0	18.2	31.7	19.3	25.2	15.9	NA	NA
18. Mysore	1. Mysore	27.5	18.6	27.8	15.4	29.9	19.7	29.5	19.5	29.5	19.2	29.4	19.1	29.6	20.7	30.2	19.1	27.8	19.0	29.5	18.7	30.1	19.1	30.0	19.0	30.3	18.2

Source: India Meteorological Department, Government of India, Bangalore

Name of species	*Family*	*District where the species are available.*
IV. Rare Species:		
1. Dalechampia stenologa Raghavan et Kulkarni	Euphorbiaceae	Chikmagalur.
2. Leucas angustissima Sedqw.	Lamiaceae	U.Kannada
3. Eria albiflora Rolfe	Orchidaceae	Hassan
4. Glyphochloa divergens (Hook) Clyton	Poaceae	Kodagu

FORESTS

Territorial Circles and the Divisions (From 8th May, 1992)

Add to page 126:

1)*Bangalore Circle, Bangalore*: i) Bangalore Urban Division, Bangalore, (ii)Bangalore Rural Division, Bangalore, (iii) Kolar Division, Kolar, (iv)Tumkur Division, Tumkur and (v)Chitradurga Division, Chitradurga.

2) *Belgaum Circle, Belgaum* : (i) Belgaum Division, Belgaum, (ii) Dharwad Division, Dharwad, (iii)Gadag Division, Gadag, (iv)Gokak Division, Gokak,and (v) Bagalkot Division, Bagalkot.

3) *Bellary Circle, Bellary :* (i) Bellary Division, Bellary, (ii) Bidar Division, Bidar, (iii) Gulbarga Division, Gulbarga and (iv) Raichur Division, Raichur.

4) *Canara Circle, Dharwad* : (i) Honnavar Division, Honnavar, (ii) Sirsi Division, Sirsi, (iii) Karwar Division, Karwar, (iv)Yellapur Division, Yellapur and (v) Haliyal Division, Haliyal.

5) *Kodagu Circle, Madikeri* :(i) Madikeri Division, Madikeri, (ii) Mangalore Division,Mangalore, (iii)Kundapur Division, Kundapur and (iv) Virajpet Division, Virajpet.

6) *Shimoga Circle, Shimoga* : (i)Sagar Division, Sagar, (ii)Shimoga Division, Shimoga, (iii)Koppa Division, Koppa, (iv) Bhadravathi Division, Bhadravathi and (v)Chikmagalur Division, Chikmagalur.

7) *Mysore Circle, Mysore* : (i) Mandya Division, Mandya, (ii) Kollegal

Add to Part I, Page 125 :

Table No. 1.8 Districtwise Forest Area vis-a-vis Geographical Area for 1990-91

Division	District	Geographical Area Sq.km	Forest Area Sq.km	%age of Forest area to geographical area	Population 1991 census	Per capita land area in ha	Per capita Forest area in ha
Bangalore Division	1. Bangalore	2,190	73.64	3.36	48,39,162	0.05	0.002
	2. Bangalore Rural	5,815	1,094.38	18.82	16,73,194	0.35	0.07
	3. Kolar	8,223	1,039.41	12.64	22,16,889	0.37	0.05
	4. Tumkur	10,598	865.17	8.16	23,05,819	0.46	0.04
	5. Chitradurga	10,852	1,562.29	14.40	21,80,443	0.50	0.07
	6. Shimoga	10,553	3,270.16	30.99	19,09,663	0.56	0.17
	Division Total	48,231	7,905,05	16.39	1,51,25,170	0.32	0.05
Mysore Division	7. Mysore	11,954	4,129.62	34.55	31,65,018	0.38	0.13
	8. Mandya	4,961	271.81	5.48	16,44,374	0.30	0.02
	9. Hassan	6,814	541.07	7.90	15,69,684	0.44	0.03
	10. Chikmagalur	7,201	2,179.08	30.26	10,17,283	0.71	0.21
	11. D.Kannada	8,441	5,182.30	61.39	26,94,264	0.31	0.19
	12. Kodagu	4,102	1,259.52	30.71	4,88,455	0.85	0.26
	Division Total	43,473	13,563.40	31.20	1,05,79,078	0.41	0.13
Gulbarga Division	13. Bellary	9,885	1,743.53	17.64	18,90,092	0.52	0.09
	14. Raichur	14,017	1,090.03	7.78	23,09,887	0.61	0.05
	15. Gulbarga	16,224	1,137.85	7.01	25,82,169	0.63	0.04
	16. Bidar	5,448	482.31	8.85	12,55,799	0.44	0.04
	Division Total	45,574	4,453.72	9.77	80,37,947	0.57	0.06
Belgaum Division	17. Belgaum	13,415	2,245.67	16.74	35,83,606	0.38	0.06
	18. Bijapur	17,069	827.58	4.85	29,27,990	0.59	0.03
	19. U.Kannada	10,291	8,291.51	80.57	12,20,260	0.84	0.68
	20. Dharwad	13,738	1,436.73	10.46	35,03,150	0.39	0.04
	Division Total	54,513	12,801.49	23.48	1,12,35,006	0.49	0.11
	State Total	1,91,791	38,723.54	20.19	4,49,77,201	0.43	0.09

Source: 1) Annual Report, Forest Dept. 1990-91, Page-27 Table I: 2) Final population totals, census of India, 1991, series II, Karnataka.

Division,Kollegal. (iii) Mysore Division, Mysore, (iv) Hassan Division, Hassan and (v) Mysore West Division, Hunsur.

Social Forestry Circles and Divisions (from 8th May 1992)

1) *Bangalore Circle, Bangalore* :(i) Bangalore S.F.Division, Bangalore, (ii) Kolar S.F.Division, Kolar, (iii) Tumkur S.F.Division, Tumkur, (iv)Mandya S.F.Division, Mandya, (v)Mysore S.F.Division, Mysore and (vi)Chitradurga S.F.Division, Chitradurga.

2) *Dharwad Circle, Dharwad* : (i) Dharwad S.F.Division, Dharwad, (ii) Uttara Kannada S.F.Division, Uttara Kannada, (iii) Belgaum S.F.Division, Belgaum and (iv) Bijapur S.F.Division, Bijapur.

3) *Hassan Circle, Hassan* : (i)Hassan S.F.Division, Hassan,(ii)Kodagu S.F.Division, Kodagu, (iii) Dakshina Kannada S.F.Division, Mangalore, (iv) Shimoga S.F.Division, Shimoga and (v) Chikmagalur S.F.Division, Chikmagalur.

4) *Gulbarga Circle, Gulbarga* : (i) Bidar S.F.Division, Bidar, (ii) Gulbarga S.F.Division, Gulbarga, (iii) Raichur S.F.Division, Raichur and (iv) Bellary S.F.Division, Bellary.

Wildlife Circles and Divisions (from 8th May 1992)

1. *Mysore Circle, Mysore* : (i) Hunsur W.L.Division, Hunsur, (ii) Project Tiger Division, Gundlupet, (iii) Chamrajnagar W.L.Division, Chamarajnagar and (iv) Cauvery W.L.Division, Kanakapura.

2) *Shimoga Circle, Shimoga* : (i) Bhadra W.L.Division, Chikmagalur, (ii) Kudremukh W.L.Division, Karkala, (iii) Dandeli W.L.Division, Dandeli and (iv)Shimoga W.L.Division, Shimoga.

Karnataka Social Forestry Project

Karnataka Social Forestry Project (World Bank Aided) is being implemented since 1983-84 with the total outlay of Rs. 53.25 crores, out of which 47.7% is from World Bank, 40.6% is from Overseas Development Administration of Britain and 11.7% is from the State and Central Governments. The Scheme was extended upto the end of 1991-92 and the State Government has provided funds for the year 1992-93. The main objectives of the scheme are as follows: to provide fuel wood, small timber, fodder and bamboos for cottage Industries and distribution of seedlings at free of cost to raise plantations in private holdings. To implement the extension programmes satisfactorily, motivators have been appointed. To train the personnel engaged in Social Forestry work, training centres at Thattihalla in Uttara Kannada and at Kadugodi in Bangalore have been started. The districtwise plantations raised under Social

Table No. 1.9 District wise Forest area by Legal Status 1990-91 in sq. kms.

Division	*District*	*Reserved*	*Protected*	*Unclassed*	*Village*	*Private*	*Total*
	Bangalore	45.86	27.78	-	-	-	73.64
	Bangalore Rural	1,078.11	8.27	-	8.00	-	1,094.38
	Kolar	877.93	43.31	61.56	56.61	-	1,039.41
	Tumkur	775.58	21.21	59.70	-	8.68	865.17
	Chitradurga	958.30	5.05	593.60	5.74	-	1,562.29
	Shimoga	1,945.72	1,298.28	21.57	13.57	-	3,270.16
Bangalore Division	Total	5,681.50	1,403.90	736.43	83.94	8.68	7,905.05
	Mysore	3,875.59	3.17	250.86	-	-	4,129.62
	Mandya	137.19	6.06	123.56	-	-	271.81
	Hassan	448.71	-	86.95	5.41	-	541.07
	Chikmagalur	1,431.72	184.32	555.29	7.75	-	2,179.08
	D. Kannada	2,121.43	1,563.62	1,408.64	-	88.61	5,182.30
	Kodagu	1,136.46	27.14	95.92	-	-	1,259.52
Mysore Division	Total	9,151.10	1,784.31	2,426.22	13.16	88.61	13,563.40
	Bellary	1,236.21	-	477.59	-	29.71	1,743.53
	Raichur	251.74	93.40	744.89		-	1,090.03
	Gulbarga	345.64	-	785.61	6.60	-	1,137.85
	Bidar	63.35	90.89	328.07	-	-	482.31
Gulbarga Division	Total	1,896.94	184.29	2,336.16	6.60	29.73	4,453.72
	Belgaum	2,057.42	11.78	52.94	-	123.43	2,245.57
	Bijapur	824.19	0.11	3.28	-	-	827.58
	U.Kannada	7,727.84	547.77	-	20.90	-	8,291.51
	Dharwad	1,271.54	14.01	93.21	-	57.97	1,436.73
Belgaum Division	Total	11,880.99	568.67	149.43	20.90	181.40	12,801.39
	State Total	28,610.53	3,932.17	5,748.24	124.20	308.42	38,723.56

Source : Annual Report of Forest Department - 1990-91

Forestry Programme from 1983-84 to 1987-88 (in ha) is given in Table No 1.12.

Survey and Demarcation

Table 1.10 Forest Area by Management, Legal Status and Type

(in thousand hectares)

Sl.No.	*Particulars*	*1980-81*	*1984-85*	*1985-86*	*1986-87*	*1987-88*	*1988-89*
1.	By Management (a to d)	3,838	3,865	3,865	3,865	3,865	3,865
	a. Forest Department	3,430	3,446	3,446	3,446	3,446	3,446
	b. Revenue Department	377	376	376	376	376	376
	c. Corporate Bodies	-	12	12	12	12	12
	d. Private	31	31	31	31	31	31
2.	By Legal Status (a to e)	3,838	3,865	3,865	3,865	3,865	3,865
	a. State/Reserve Forests	2,840	2,858	2,858	2,858	2,858	2,858
	b. Minor or Protected Forests	395	395	395	395	395	395
	c. Unclassified Forests	560	569	569	569	569	569
	d. Village Forests	12	12	12	12	12	12
	e. Private Forests	30	31	31	31	31	31
3.	By Type (a to f)	3,838	3,865	3,865	3,865	3,865	3,865
	a. Ever-Green Forests	580	580	580	580	580	580
	b. Semi-Evergreen Forests	-	-	-	-	-	-
	c. Moist Deciduous Forests	578	578	578	578	578	578
	d. Dry Deciduous Forests	727	727	727	727	727	727
	e. Shrub and Thorny Forests	818	818	818	818	818	818
	f. Others (Unforested)	1,135	1,162	1,162	1,162	1,162	1,162

Source : Statistical Abstract of Karnataka 1988-89

Table No. 1.11 Outturn of Forest Produce

Sl.No.	*Type of product*	*Unit*	*1980-81*	*1984-85*	*1985-86*	*1986-87*	*1987-88*	*1988-89*
1	2	3	4	5	6	7	8	9
A.	**Major**							
1.	**Timber,**							
	a) Rose Wood	Cubic metres	12,395	3,289	4,928	5,010	7,590	5,218
	b) Teak Wood	00' Cubic metres	731	128	114	122	165	93
	c) Other kinds of timber	000' Cubic metres	248	139	139	166	120	110
2.	Pulp Wood	- do -	303	172	208	234	183	142
3.	Plywood	00' Cubic metres	1,307	859	487	302	224	82
4.	Match Wood	Cubic metres	15,700	14,625	8,055	1,184	823	1,252
5.	Sawn Timber	- do -	10,805	3,166	2,,077	728	307	2,617
6.	Timber in round pole	00' Cubic metres	1,042	464	306	402	454	387

Sl.No.	Type of product	Unit	1980-81	1984-85	1985-86	1986-87	1987-88	1988-89
1	2	3	4	5	6	7	8	
7.	Fire Wood	000' Cubic metres	1,069	542	499	785	445	463
8.	Bamboo	00 tonnes	1,436	862	688	329	405	495
9.	Sandalwood	Tonnes	1,600	1,989	2,049	1,426	948	1,280
B.	**Minor**							
1.	Charcoal	Tonnes	6,792	461	453	-	-	-
2.	Cane	Tonnes	757	2,763	1,528	1967	906	1,821
3.	Rubber	Tonnes	1,660	2,258	2,618	2,221	2,482	3,732
4.	Cashewnuts	Tonnes	588	265	203	414	389	347
5.	Ivory	Kgs	602	85	125	420	119	128
6.	Honey	Tonnes	82	64	43	43	27	50
7.	Wax	Tonnes	5	6	11	39	9	18
8.	Barks	Tonnes	1,480	507	308	296	271	827
9.	Tamarind	Tonnes	653	1,099	873	737	1,427	750
10.	Oilseeds	Tonnes	556	7	522	304	783	654
11.	Oils (Eucalyptus & Rosha)	Kgs	269	670	7,548	3,536	154	100
12.	Seegekai	Tonnes	708	901	814	767	436	686
13.	Gums	Tonnes	12	42	121	18	28	11
14.	Spices	Tonnes	216	3	2	1	44	161
15.	Antavalakai	Tonnes	111	185	174	157	95	381
16.	Alamaddi (Dhoop)	Tonnes	208	53	327	22	79	68
17.	Seeds (Misc)	Tonnes	263	220	277	48	38	51
18.	Myrobalan	Tonnes	283	171	208	418	164	836
19.	Beedi Leaves	Tonnes	384	1,544	1,489	1,155	1,315	1,236
20.	Others	Tonnes	12,096	1,080	569	485	462	1,389

Source Statistical Abstract of Karnataka 1988-89

State Government has transferred 7,72,679 acres of C and D class land to the Forest Department by 31.1.1989, as can be seen from the Table No. 1.13.

A Government notification dated 7.6.1993 says that the Forest Department had developed and notified 67,000 ha, only and there has been a plan to further transfer 1.25 lakh ha, where plantations were raised, but not notified; another 2.58 ha, of C and D class lands are ordered to be transferred after this Government Order dated 7.6.1993.

Add to Part 1 Page 152, after 5th para:

The capital invested in the Karnataka State Forest Industries Corporation limited as on 31st Dec. 1992 amounted to Rs.115.53 lakhs. It has two subsidiary

Table No. 1.12 Districtwise Plantation raised under Social Forestry Programme for the Period from 1983-84 to 1987-88 (Area in ha)

Sl. No.	District	Gomal Lands	C&D Lands	Tank Foreshore	Bamboos	Farm Forestry	Total Plantations	Canal Banks	Road Side	Total Plantations (Km)
1.	Bangalore (R)	178	305	274	50	500	1,307	-	310	310
2.	Bangalore	16	40	43	10	11	120	-	45	45
3.	Belgaum	1,097	1,315	144	100	245	2,901	142	384	526
4.	Bellary	198	314	295	30	182	1,016	33	113	146
5.	Bidar	100	1,102	89	13	141	1,445	30	198	228
6.	Bijapur	397	1,060	181	78	121	1,837	189	267	456
7.	Chikmagalur	466	83	15	131	120	815	14	78	92
8.	Chitradurga	710	997	382	22	166	2,277	54	226	280
9.	Dakshina Kannada	164	80	0	83	89	416	-	166	166
10.	Dharwad	395	487	127	147	128	1,284	62	274	336
11	Gulbarga	365	356	114	8	153	1,006	55	199	154
12.	Hassan	1,033	607	150	98	168	2,056	49	160	209
13.	Kodagu	0	54	0	62	60	176	40	75	115
14.	Kolar	680	270	766	50	380	2,146	-	215	215
15.	Mandya	54	92	342	47	367	902	102	206	308
16.	Mysore	281	447	338	101	259	1,426	83	198	281
17.	Raichur	223	963	146	20	182	1,534	89	293	382
18.	Shimoga	119	188	108	141	118	674	46	159	205
19.	Tumkur	2,255	294	306	34	278	3,167	-	206	206
20.	Uttara Kannada	0	250	0	386	190	826	-	119	119
	State Total	8,728	9,304	3,820	1,611	3,868	27,331	988	3,891	4,879

Source: Karnataka Forest Department, Statistical, Brochure 1987.

Table No. 1.13 Statement showing the Government Waste Lands transferred to the Forest Department as on 31.1.1989 Area in acres

Sl.No.	Name of the District	Total availability of Govt Vacant Waste Lands	Total Area Surveyed & Categorised	Extent of C&D class lands available for transfer to Forest Department			C&D lands transferred from Revenue Dept to Forest Department		
				'C' Class	'D' Class	Total	'C' Class	D' Class	Total
1	2	3	4	5	6	7	8	9	10
Belgaum Division									
1.	Bijapur	3,249	3,249	75	1,592	1,667	36	136	172
2.	Dharwad	16,098	16,098	2,626	5,413	8,039	745	19,41	2,686
3.	Belgaum	8,375	8,375	8,70	4,016	4,886	497	30,22	3,519
4.	Uttara Kannada	13,791	13,791	3,017	739	3,756	747	525	1,272
Mysore Division									
5.	Mysore	425,323	96,123	20,127	5,575	25,702	11,441	1,894	13,335
6.	Mandya	213,207	74,741	26,605	17,518	44,123	27,658	13,992	41,650
7.	Hassan	330,113	99,785	27,981	13,806	41,787	21,097	15,503	36,600
8.	Chikmagalur	352,071	95,519	31,558	14,742	46,300	29,121	17,706	46,827
9.	Kodagu	78,783	78,783	37,310	647	37,957	25,474	13,273	38,747
10.	Dakshina Kannada	250,129	104,481	77,230	7,397	84,627	73,763	12,702	86,465
Bangalore Division									
11.	Bangalore	214,464	65,989	15,702	30,046	45,748	5,183	12,784	17,967
12.	Shimoga	477,295	108,469	65,961	5,821	71,782	66,658	5,372	72,030
13.	Tumkur	370,881	117,170	23,611	4,568	28,179	24,821	21,001	45,822
14.	Kolar	231,009	123,877	32,787	55,156	87,943	34,559	56,989	91,548
15.	Chitradurga	210,925	127,998	41,034	36,444	77,478	34,792	34,990	69,782
Gulbarga Division									
16.	Gulbarga	135,684	112,980	44,694	40,716	85,410	61,056	31,238	92,294
17.	Bellary	138,315	117,723	40,122	37,739	77,861	36,898	27,549	64,447
18.	Bidar	58,104	57,800	36,077	12,018	48,095	20,999	8,226	29,225
19.	Raichur	82,713	65,125	31,759	18,378	50,137	10,179	8,112	18,291
	State Total	3,610,528	1,488,076	559,146	312,331	871,477	485,724	286,955	772,679

Source: Statistical Brochure, Forest Department 1987

companies *viz*, Karnataka Veneer Ltd., Dandeli and the Mysore Match Company Ltd., Shimoga.

Add to Page 153 after 1st para :

The corporation is running two saw mills at Shimoga and Dandeli. During 1992-93 upto 31st Dec.1992, 24,803 cubic metres of timber was purchased by incurring an expenditure of Rs.3.32 lakhs. About 416 cubic metres of timber was sawn and 160 cubic metres of timber was sold for Rs.12 lakhs.

KSFIC has opened a new factory at Timber Yard Layout, Bangalore for the manufacture of black boards, flush doors and sandal wood white chips pulverisation. The total production and sales of the products during 1992-93 are indicated here.

	Production Quantity	Sales Quantity	Sales Rs. Lakhs
1) Black boards and flush doors	56,710 sq.ft	81,270 sq.ft	23.47
2) Sandalwood white chips powder	21.76 Mt	21.76 Mt	6.02
3) Balloon dust	0.96 MT	0.96 MT	0.13

The Corporation has supplied 263 M.T. of polythene bags worth Rs.156.3 lakhs, 10.6 MT of black bags/sheets worth Rs.13.62 lakhs and 4.89 high density polyethylene woven bags worth Rs.18.69 lakhs to the forest department during 1992-93 upto 31st Dec.1992.

There were 63 firewood depots under the control of KSFIC during 1992 and through these outlets, firewood was supplied to the public at reasonable rates. Logging activities are taken by KSFIC with the objective to eliminate the middlemen and to extract salvageable and firewood by reducing damages to standing crops. During 1992-93, about 21.8 thousand M.T. firewood worth Rs.93 lakhs was sold to public upto 31st Dec. 1992.

During the year 1989-90 a Fenny Project at Gujjady (Kundapur) was taken up and plants and machineries were installed at a cost of Rs.34 lakhs. The project is meant to utilise profitably available cashew apple instead of throwing it as a waste. The installed capacity is 9 tonnes of apple per day for 100 days. It is expected to produce 47,000 bottles of fenny (750 ml). In addition during the off-season, the same plant can be used for producing fenny from toddy. It is decided to lease out this project as the produce could not be marketed by the Corporation.

Add to part I Page 154 after 4th para:

Forest Plantations Corporation

The authorised share capital of Rs.2 crores in 1971 was raised to Rs.10 crores during 1981-82 and to Rs.25 crores during 1986-87. As on 31st March 1991 the Karnataka Forest Development Corporation Limited had a capital of Rs.25 crores and paid-up capital of Rs.840 lakhs.

Add to Part I Page 155 after Ist para:

About 34,800 ha of eucalyptus plantations which were raised by the Forest Department was transferred to the Corporation during July 1976 and the revenue obtained is being utilised for developmental works. The Corporation has raised 52,926 ha of eucalyptus plantations by obtaining institutional finance. It has started extracting pulpwood from these plantations since 1982-83. During 1992-93 29,940 tonnes of raw materials has been marketed and revenue of Rs.230.85 lakhs has been obtained.

Add to Page 155 after IInd para :

The Corporation owns 1,672 ha. (1992) of cocoa plantations including 1,053 ha cocoa plantations taken over from the Forest Department in 1976. These plantations have been handed over to M/s. Campco, a co-operative unit for management, harvesting and development on lease basis for a period of 20 years from April 1984. Campco will pay a royalty of Rs.55 lakhs to the Corporation over a period of 10 years. The Government have directed the Corporation to take over the plantation and simultaneously hand it over to the Forest Department in its order dated 29-6-1992. It is under process.

Add to Page 155, After IIIrd para:

At present, rubber tapping is being done over an area of 3,500 ha. During 1992-93, 2,148 metric tonnes of rubber was obtained and a revenue of Rs.626 lakhs was realised. In consultations with the Rubber Board, a project for replanting in 908 ha has been prepared out of 4,445 ha of rubber plantations taken over from Forest Department in Sullya and Aivarnad divisions at a financial outlay of Rs.530 lakhs.

The Corporation has constructed its office complex at Malleswaram by incurring an expenditure of Rs.1.4 crores and the office is functioning since January 1990. The Corporation has taken up the construction work of hotel complex at Murkal for the benefit of tourists visiting Nagarhole National Park. Certain old buildings have been renovated for use by wild life tourists from April, 1992. The Government have approved the leasing out of the hotel complex at Murkal to M/s. Gateway Hotel and Gateway Resorts Ltd. (Taj

Group of Hotels) for a period of 18 years for a total sum of Rs.425 lakhs and the execution of agreement is under process.

About 310 ha of Bursera plantations raised by Forest Department in Hoskote taluk have been taken over by the Corporation for management and maintenance out of its internal resources. During 1992-93, the Corporation collected 19,800 tonnes of husk for distilling 17,800 kg of oil and the expected revenue is about Rs.8.5 lakhs.

Tea Project

The Corporation has raised 42 ha of tea plantations upto 1992 besides maintaining 13.9 ha raised by Forest Department. The plantations are being maintained at sustainance level with its internal resources. The plantations are being leased out for a period of 15 years.

Add to Page 156 after Ist para:

Cashew Development Corporation.

The Cashew Department Corporation is implementing the cashew project assisted by the International Development Association (IDA). In addition to head office at Mangalore, there are divisional offices at Kundapur, Kumta and Mudabidre. The Corporation has been established with the participation of the equity share capital of Government of India as well as Government of Karnataka at 49:51 ratio. There is a porposal to transfer 20,000 ha of cashew plantations raised by the Forest Department to the Corporation.

IDA, World Bank aided cashew project, envisaged raising of 2,500 ha of new cashew plantations and improvement of existing cashew plantations raised between 1980-81 to 1984-85; 2,564 ha plantations were raised during that period. During the period from 1985-86 to 1987-88 1,400 ha of cashew plantations were raised under IDA additional project. The revenue realised for the period 1990-91 to 1991-92 (two years) was Rs.12.57 lakhs. Total expenditure of Rs.112.97 lakhs has been incurred from 1985-86 to 1990-91. The Corporation has established twelve clonal orchards and clonal banks.

Pavitra Vanas

Medicinal plants are one of the chief components of our natural resources. They comprise nearly 25 percent of the species of higher plants. About 450 species are frequently used in traditional systems of medicine. They are found under various types of habitats. Karnataka Forest Department has taken some steps to conserve and protect the medicinal plants by creating a chain of 'Pavitra Vanas' (Sacred Forests) and the 'Garden of Medicinal Plants'. Genepools and gardens in various bioclimatic zones of Karnataka State have been established

with the following objectives *viz*,. to grow naturally occurring species of the surrounding areas in a genepool and develop nurseries for propagation of planting material for supply to the cultivators; to develop nursery techniques for propagation and cultivation of the plants which have higher demand in the locality; to identify authentically the medicinal plants referred to in Ayurveda and to publish basic ethnic and botanical literature for awareness, information and commerce, and to suggest to the Government to bring in required legislation to insist on all pharmaceutical industries to ensure raw material sources before establishing large scale manufacturing units. The very objectives of creating Herbal Gardens and Genepools are for collection and growing of all medicinal plant species.

Herbal Gardens are established at Terekanahalli and Bakkal Vana both near Sirsi (Uttar Kannada), in Bangalore University Campus, Channapatna (Bangalore Rural district), Gungargatti near Dharwad and Kaivara in Kolar District. The Bakkal Vana near Sirsi has an assemblage of plants on several lines such as types of forest (wet evergreen, moist deciduous and dry deciduous forest types) on mythological lines such as Nakshatra Vana and Rashi Vana. The Dhanvantri Vana near Bangalore University campus is designed and developed to help studies of Indian systems of medicine (Ayurveda, Siddha and Unani) and also to cater to the needs of drug preparation by research institutions.

The medicinal plants conservation reserves are the natural areas comprising especially the medicinal plants in different bioclimatic regions. The major reserves identified are Savanadurga (Bangalore Rural Dist.), B.R.T. Hills (Mysore District), Charmadi and Kanapadi (Dakshina Kannada Dist.), Agumbe (Shimoga Dist.), Talakaveri (Kodagu district) and Sandur (Bellary district). The main objectives of the Medicinal plants conservation Reserves are to protect the valuable species in their natural habitats; to carryout scientific studies to understand the dynamics of succession of the individual species and their interactions and to understand the complex nature of ecosystems to propagate plants and to restore degraded ecosystems.

Wild life

Add to part I, page 159; after II para:

With the object of conserving wild life in general and endangered species in particular, the State has constituted five National Parks and 19 Wildlife Sanctuaries covering an area of 6,644 sq. km. This forms 17.5% of the total forest (1992) as against 3.2% during 1972. The National Parks and Sanctuaries comprise of evergreen to scrub type of forests thus forming a network of representative ecosystem to conserve endangered species of plants as well as animals and birds.

The list of National Parks and Wildlife Sanctuaries of the State which have undergone many changes after 1982 is given below.

Sl.No.	*National park/Sanctuary*	*Area Sq. km*	*District*	*Established during*
1.	Anshi National Park	250.00	Uttara Kannada	1987
2.	Bandipur National Park	874.20	Mysore	1974
3.	Bannerghatta National Park	104.27	Bangalore	1974
4.	Kudremukh National Park	600.32	Chikmagalur	1987
5.	Nagarahole National Park	643.39	Mysore & Kodagu	1988
6.	Adichunchanagiri Peacock Sanctuary	0.84	Mandya	1981
7.	Arabitittu Wildlife Sanctuary	13.50	Mysore	1985
8.	Bhadra Wildlife Sanctuary	492.46	Chikmagalur and Shimoga	1974
9.	Biligiri Rangaswamy Temple Wildlife Sanctuary	539.52	Mysore	1987
10.	Brahmagiri Wildlife Sanctuary	181.20	Kodagu	1974
11.	Mookambike Wildlife Sanctuary	247.00	Dakshina Kannada	1974
12.	Nugu Wildlife Sanctuary	30.32	Mysore	1974
13.	Sharavathy Valley Wildlife Sanctuary	431.23	Shimoga	1974
14.	Someshwara Wildlife Sanctuary	88.40	Dakshina Kannada	1974
15.	Shettyhalli Wildlife Sanctuary	395.60	Shimoga	1974
16.	Ranebennur Wildlife Sanctuary	119.00	Dharwad	1974
17.	Pushpagiri Wildlife Sanctuary	102.59	Kodagu	1974
18.	Cauvery Wildlife Sanctuary	510.00	Mysore	1987
19.	Talakaveri Wildlife Sanctuary	105.01	Kodagu	1987
20.	Melkote Temple Wildlife Sanctuary	49.82	Mandya	1974
21.	Ghataprabha Bird Sanctuary	29.79	Belgaum	1974
22.	Dandeli Wildlife Sanctuary	843.16	Uttara Kannada	1987
23.	Ranganatittu Bird Sanctuary	0.67	Mandya	1940
24.	Gudavi Bird Sanctuary	0.73	Shimoga	1989
	Total Area (Sq.km)	6,644.00		

Apart from the officially declared sanctuaries, naturally developed bird Sanctuaries at Kokrebellur near Maddur and Mandagadde in Thirthahalli taluk attract a large number of migratory birds every year. Annually approximately

more than two lakh visitors visit the National Park and Sanctuaries yielding revenue of about nine lakh rupees.

Nilgiri Biosphere Reserve

The Nilgiri Biosphere, the first biosphere reserve in the Country was constituted in September 1986. The Nilgiri Biosphere spreads over the States of Karnataka, Tamil Nadu and Kerala over an area of 5,520 sq. km of which 1,517.95 sq. km lie in Karnataka State. The biosphere reserve includes the National Parks of Nagarhole and Bandipur. Systematic management in Karnataka has been initiated since 1987 onwards and stress has been laid on survey, protection, restoration and educational awareness. The range of wildlife in the area presents a wide spectrum of all species that are found in South India.

Wildlife is increasing rapidly. An Elephant and Bison Census was carried out in the State during 1983. As per the Census there were 3,579 elephants of which 704 are males, 2,068 females and 807 juveniles. There were 5,316 bisons of which 4,244 were adults and 1,072 young ones. A Tiger-cum-Cat Census coinciding with the all-India Census was carried out during 1984. There were 202 tigers of which 73 were males, 94 females and 35 cubs. Similarly 230 panthers were counted which was a conservative count. A Census of the larger mammals was carried out in 1989 coinciding with the all-India Census. As per the Census there were 257 tigers, 283 Panthers, 4,418 Elephants out of which 974 are males, 2,107 females and 1,337 juveniles. The number of bisons was 5,473. As per the latest census (1993) there were 5,098 elephants of which 1,110 were adult males 2,916 adult females and the rest juveniles. Over 30% of this elephant population was concentrated in Mysore and Kodagu district.

To create awareness about the Flora and Fauna in the minds of the public in general and school children in particular, the Wild Life Wing of the Forest Department has been conducting Nature Camps, field excursions, trekking etc., at Bannerghatta, Bandipur and Nagarahole National Parks and in the Wildlife Sanctuaries at Bhadra, Ranebennur and Dandeli. Children are permitted to stay at the camps for two or three days and the importance of both the Flora and Fauna is made known in addition to trekking, bird watching, campfires, etc. Number of youth and honorary organisations have also been showing keen interest in the conservation and wild life education like Coorg Wildlife Society (Madikeri), Wildlife Environment Awareness Foundation (Bangalore), Wildlife Preservation Group (WILPEG) Bangalore) World Wild Life Fund, Bangalore etc.

In Karnataka, hunting has been totally banned. The rapid growth of

population, industrialisation, mining, quarrying, grow more food campaign etc. have shrunk the wildlife habitat. Agricultural land being contiguous to the forest, it is but natural for wildlife to stray into the adjoining field and forage agricultural crops resulting in damage to crops like sugarcane, paddy and plantation crops like banana, coconut, coffee etc. Government compensate the farmers for any loss caused to the crop as well as any injury or death to human life. List of such cases with details of damage and the compensation paid for the past years is given below.

Year	Compensation paid for					
	Crop		Cattle		HumanDeath	
	Cases	Amount	No.	Amount	No.	Amount
1984-85	1,251	8.13	780	3.42	39	1.40
1985-86	690	7.26	1,752	6.69	38	0.89
1986-87	1,485	5.70	1,194	4.48	39	1.07
1987-88	1,238	3.77	555	2.95	17	0.70
1988-89	1,542	5.61	1,149	4.44	38	0.85
1989-90	1,790	7.26	1,943	6.88	38	1.81
1990-91	1,986	7.65	1,409	5.72	30	2.70
1991-92	3,224	22.61	1,746	8.37	45	5.31

Government is considering establishing a Sloth Bear Sanctuary at Daroji near Hospet in Bellary District with Central assistance. The proposed Sanctuary will protect the Flora and Fauna of the area in general and sloth bear in particular within its original habitat and to propagate their progeny. The safaris (tiger and lion) established at Bannerghatta National Park, Bangalore and Tyavarakoppa in Shimoga district have gained popularity attracting good number of visitors. There is also a proposal to establish one more safari between Hubli-Dharwad and to improve and expand the mini zoo at Gadag. A safari park is not a conventional zoo. It is a place of education, entertainment and enlightenment. It serves as a safe home for endangered species.

The visitation to some of the National Parks and Wildlife Sanctuaries and the revenue realized during 1991 are as follows:

National Park /Sanctuary	*Tourists*	*Revenue (Rs. Lakhs)*
1. Bannerghatta N.P.	7,01,123	26.98
2. Bandipur N.P.	25,336	5.43
3. Nagarhole N.P.	35,382	5.12
4. Ranganathittu Bird Sanctuary	1,24,703	3.58

Add to Part I, Page 165, First table :

Revenue and Expenditure (Rs in lakhs) from 1982-83 to 1987-88

Particulars		*1982-83*	*1983-84*	*1984-85*	*1985-86*	*1986-87*	*1987-88*
Revenue							
Timber Extraction by Government agency		3671.51	4568.93	4636.31	4473.91	4163.09	4389.45
Extracted by consumers and purchasers		516.92	528.40	600.69	832.19	683.77	407.79
Receipts from forest Plantations		86.50	44.90	64.12	55.11	53.75	121.43
Other items		175.88	199.05	279.3	285.99	404.90	328.51
Total Revenue		4450.81	5341.28	5580.42	5647.2	5305.56	5247.18
Deduct refunds		3.54	2.24	6.84	11.32	4.53	9.45
Net revenue		4447.27	5339.04	5573.58	5635.88	5301.03	5237.73
Taxes and Duties		325.61	392.48	441.24	475.3	397.53	449.27
Expenditure							
Administration	non-plan	737.04	840.45	1002.01	1077.7	1245.77	1633.06
Developmental	work-plan	514.41	742.82	1189.25	1265.16	1506.25	1553.5
	non-plan	537.7	601.77	646.40	913.56	900.15	1044.54
Forest produce							
Extraction	non-plan	720.28	797.54	1026.01	1150.59	1139.44	1338.14
Wildlife preservation	plan	83.65	106.53	113.25	94.15	120.79	204.71
	non-plan	7.23	16.46	27.16	26.1	45.12	58.78
Others	plan	84.3	127.51	122.01	83.06	69.94	5.35
	non-plan	164.02	139.16	223.85	190.33	175.08	121.68
Total	plan	682.36	976.86	1424.51	1442.37	1696.98	1763.56
Total	non-plan	2166.27	2395.38	2926.16	3358.28	3505.56	4196.2

Source : Karnataka Forest Department, Statistical Brochure 1987

Land Use

The Planning Commission, Government of India felt the need for having up-to-date information for the whole Country on agriculture and other land-use categories and their estimates for agro-climatic zones planning. The work undertaken by the Department of Space, Government of India, involves preparation of Land use/land cover maps in 1:2,50,000 scale of all the districts in the Country. The Land use maps of districts are prepared by Karnataka State Remote Sensing Technology Utilization Centre, Bangalore. Visual interpretation of IRS LISS-1 data of November/December, 1988 (Kharif) and February 1989 (Rabi) and combined maps for the year 1988-89 have been prepared. The major categories identified include built-up land, agricultural land, forests, waste lands, water bodies and others. The detailed statistics for the year 1988-89 is given in table no.1.14. The land use/land cover maps prepared by using satellite data not only gives the spatial distribution but also the aerial extent of each class. Thus information received through satellite imagery using this methodology will help planning.

Tidal Wetland Mapping

Tidal wetlands have been recognised as a significant ecosystem which play an important role in bio-geochemical cycle by trapping the silt and clay, recharging the groundwater and even cleansing certain toxic components from effluent water, to which they are aptly called as 'Kidneys of landscape'. They also provide a unique habitat for Flora and Fauna and are responsible for conserving reproductive fisheries. These wetlands have been mapped by using remote sensing.

All the tidal wetland classes are identified and delineated based on the standard image interpretation. The entire Karnataka coast has been mapped using IRS data. The salient features of wetland units are as follows:

1) *Mudflat*: Mudflats are wide expanse of fine grained soft mud along the shore. They generally consist of deposits of clay, silt, ooze etc. Along the Karnataka coast mudflat areas are predominantly seen along the backwaters, creeks, on the low-lying areas adjacent to the estuaries, lagoons particularly near Karwar, Tadri, Kundapur and Mulki. It is seen from the study that the total area covered by mudflat is 3,937 ha. and the same along the individual estuarine complex is given in Table No. 1.15.

2) *Sand*: Sand is classified into various units such as beach, bar, spit, etc. Beach is defined as a shore consisting atleast partly of unconsolidated material mostly of sand grade. It is seen as a thin white, linear, discontinuous crescent shaped strip all along the coast, carpeted with beach vegetation and plantation. Spit is defined as a small point commonly consisting of sand or

gravel and having one end attached to the mainland and the other terminating to open water, usually the sea. The well developed spit is observed near Malpe, Bengre and Pavinkurve (near Honavar) region indicating the direction of littoral drift; the other spits are located at Mangalore, Kundapur, Maravante and Bhatkal. Bars are submerged ridges of detrital sediments which are larger and less regularly shaped. Shoals are either submerged ridge, bank or bar producing shoal consisting of or covered by sand, mud, gravel or other unconsolidated materials. Small pockets of shoals are identified in the estuaries and lagoons.

3) *Rocky Coast-cliff*: The cliffed or rocky coast are commonly seen near Karwar, Malpe and Bhatkal regions and are steep and lateritic in nature.

4) *Mangroves*: Mangroves are unique hallophytes aptly adapted to saline environment both morphologically and physiologically. Thick patches of mangroves are identified along Kundapur, Udupi and Karwar regions and the total spatial distribution of Mangroves is estimated as 815 ha.

5) *Beach Vegetation*: Beach vegetation is mainly observed along the Karwar and Mangalore coast where the beaches are wide and extensive.

6) *Beach Plantations*: Beach plantation comprising of casurina grown under afforestation programme to protect the coast were predominantly seen along the Mangalore, Udupi, Honnavar and Karwar areas. Other vegetation comprises of swamp/marsh/coconut plantation/scrub vegetation related to the phenomenon of regression of the sea. They may be sites of older mudflats which are under the sea.

7) *Water Bodies*: Estuaries, lagoons, creeks and bays form the major water bodies. Estuaries are usually defined as that part of the lower river course that is affected by the mixing of salt water with the fresh water. About nine major estuarine complexes were identified along the Karnataka coast. Lagoon is an elongated body of water lying parallel to the coastline and separated from the open sea by barren islands. They are predominantly seen in the Kundapur, Mangalore and Karwar regions.

8) *Creeks*: Low-land water course of medium size are called creeks, which originate from any natural stream or bay, or a narrow inlet of sea, seen commonly along the coast. The Table no.1.15 indicate them.

Shoreland: Features like Palcomud flat, Coastal dunes, Coastal dune with vegetation and strandlines are grouped under this category, paleomud flats are defined as mud flats lying above high tide flats. Coastal dunes are defined as topographical feature of eolian origin composed of sand grains deposited

Table No. 1.14 Major Land use/Land cover categories and their spatial distribution. (estimated by using Satellite Imagery)

Area in hectares

Districts	*Buit-up land*	*% to total Geog. area*	*Agricultural land*	*% to total Geog. area*	*Forest land*	*% to total Geog. area*	*Waste land*	*% to total Geog. area*	*Water bodies*	*% to total Geog. area*	*Others*	*% to total Geog. area*	*Total*
1. Bangalore	17,500	7.99	168,938	77.11	4,750	2.17	21,312	9.72	5,913	2.70	688	0.31	219,200
2. Bangalore Rural	438	0.08	407,428	69.59	61,750	10.55	106,675	18.22	8,954	1.53	188	0.03	585,431
3. Belgaum	1,750	0.13	8,792,519	65.92	180,296	13.53	247,919	18.45	25,350	1.89	880	0.07	1,341,500
4. Bellary	3,375	0.34	666,725	66.76	123,151	12.45	161.408	16.33	37,712	3.82	2,925	0.30	988.500
5. Bidar	4,436	0.82	376,751	69.16	11,279	2.06	147,161	27.01	5,173	0.95			544,800
6. Bijapur	935	0.05	1,328,649	77.84	73,352	4.30	288,455	16.90	15,509	0.91			1,706,900
7. Chikmagalur	750	0.10	340,002	47.20	295,990	41.10	66,120	9.16	12,625	1.77	4,813	0.67	720,300
8. Chitradurga	1,875	0.17	851,879	78.49	88,801	7.54	127.328	11.74	20,629	1.90	1,688	0.16	1,085,200
9. Dakshina Kannada	500	0.06	298,118	35.30	221,474	26.24	65,300	7.74	16,558	1.96	242,130	28.69	844,100
10. Dharwad	4,529	0.33	1,178,452	85.78	107,704	7.84	72,831	5.30	10,221	0.74	63	0.01	1,373,800
11. Gulbarga	1,889	0.12	1,350,320	83.21	51,071	3.15	193,223	11.90	26,265	1.62			1,622,768
12. Hassan	935	0.14	513,358	75.34	56,007	8.22	96,827	14.21	14,274	2.09			681,400
13. Kodagu	625	0.15	246,648	60.13	157.303	38.35	3,563	0.87	2,063	0.50			410,202
14. Kolar	14,376	0.18	670,927	81.59	71,443	8.69	50,562	6.15	27,931	3.31			822,300
15. Mandya	1,188	0.24	406,363	81.91	23,238	4.68	45,838	9.24	19,475	3.93			496,100
16. Mysore	4,625	0.39	735,687	61.54	342,725	28.67	76,113	6.36	30,314	2.54	5,.938	0.50	1,195,400
17. Raichur	3,223	0.23	125,744	83.45	33,124	2.36	117,592	8.39	36,554	2.60	63	0.01	1,401,700
18. Shimoga	1,035	0.10	376,030	35.63	541,416	51.30	96,038	9.10	40,871	3.87			1,055,300
19. Tumkur	562	0.05	800,941	75.57	75,223	7.11	153,511	14.49	29,348	2.77	125	0.01	1,059,800
20. Uttara Kannada	1,124	0.11	111,388	10.82	829,000	80.55	74,101	7.22	13,200	1.28	188	0.02	1,029,000
State Total	65,669	0.34	19,746,863	102.94	3,342,096	17.55	2,211,875	11.53	398,936	2.08	259,686	1.35	19,183,699

Source : Karnataka State Remote Sensing Technology Utilisation Centre, Bangalore - 22

down by wind from a natural source of sand and are extensively seen in the Kumta, Honnavar, Kundapur and Udupi regions. Strand line is an ancient shorelines, refers collectively to the assemblage of various features and characteristics of former coastal areas. It is observed all around Karwar and Honnavar coast, featuring like a lineament in the image. Salt pans are an undrained usually small and shallow, rectangular, man-made depressions in which saline water accumulates and evaporates leaving salt deposits and vast stretches of them are identified along the Tadri and Kali estuaries.

Islands: Many tiny offshore Islands are clearly visible near Malpe (St. Mary Islands), Mulki (Mulki rocks), Kundapur, Bhatkal (Jalikunda or Hog Island and Netrani or Pigeon Island), Honnavar (Basavarajadurga) and Karwar (Anjadeev belonging to Goa, Kurmagad, Devagada etc.) regions.

The information culminated is educative for the resourceful planners in taking constructive measures to conserve and apt management of the coastal environment. Marine regressions over a period of time is indicated by the presence of Paleomud flats, strand lines and lagoons identified by the studies. Along with brackish water, aquaculture sites too were demarcated to carry out pisciculture activities as a socio-economic measure near the Kumta and Ankola regions. The studies were useful in identifying vulnerable points along estuaries where afforestation of mangroves are being presently carried out.

The Environmental Situation in Karnataka*

The fertility of our land, the quality of our water and the purity of our air are in danger as we in Karnataka grow in numbers, accelerate industrial output and use up our natural resources This situation is causing concern among many of our people. The Government shares this concern. Measure are in hand to prevent or at least control the pace of this degradation.

Land: Sixty per cent of the land area in Karnataka is under one or other type of agriculture. This is above the national average of 51%. A portion of this land is marginal for agriculture and requires higher inputs but gives lower yields. As subsistence farming is economically non-viable this land is soon degraded and the soil eroded. Land that cannot support agriculture could well be suitable for forestry or pasture.

** From here to page 54,the write-up is by Prof. C.J. Saldanha*

Irrigated land has been rendered saline or water-logged often due to bad water use. Thus in the upper Krishna Project 71,000 ha have become either saline or alkaline. In the command area of the Tungabhadra Reservoir 33,000 ha are either saline or water logged; 25,455 ha are saline or waterlogged in the Malaprabha and Ghataprabha command areas and 16,555 ha in the Cauvery basin. Remedial measures are being undertaken in some areas at a high cost.

Pasture lands in the State have been steadily decreasing. During 1956-1983 pastures came down by 30.7% while animal units increased by 29.7%. Overgrazing is bound to follow together with compacting of the land by cattle paths.

Forests: The role of the forest cover in protecting and enriching the soil is well known. The forest has also an important function in water regimes especially in steep areas with high rainfall. The major forests of Karnataka are in the Western Ghat region in Chikmagalur, Dakshina Kannada, Kodagu, Shimoga and Uttara Kannada districts. Several factors have contributed to the shrinkage of moist forests in the Western Ghats. Fuelwood for the common people and timber for wood-based industries have taken their toll. Vast forest areas have been submerged by hydel projects on the west-flowing Sharavathi, Kali and Varahi rivers. Resettlement of people displaced by development projects has further reduced the forest area by honey-combing the forests with human settlements.

For the Sharavathi project alone 2,338 ha of forest were released in 189 blocks. The displaced people from Supa were resettled at Ramnagara in what was once good forest land. Further demands on forest areas are being made for the Bedthi and other river valley projects. Irrigation reservoirs on the Bhadra, Tunga and Kabini have destroyed good forests and excellent game sanctuaries.

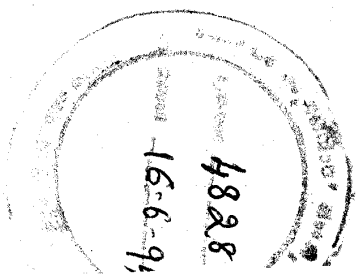
Surface Mining is another activity highly harmful to the forest cover. The schistose belts in Uttara Kannada, Chikmagalur and Bellary Districts are good forest areas. Besides the forest lost in the actual mining leases, further losses occur through road-building, townships and the other negative impacts of surface mining like erosion of tailing dumps and siltation of rivers. Compensatory afforestation and reshaping and revegetation of mined areas is now compulsory. However the damage done to the environment by surface mining is scarcely made up by these measures.

Plantations: The forest areas in the Western Ghats are being converted into plantations of cardamom, cocoa, coffee and tea. Simultaneously timber and fuel-wood species are replacing the rich tropical forests often as monocul-

Table No. 1.15 Wet land types in Karnataka Coast

Area In. Sq.ha

Estuarine complex	Non-Vegetated Wetlands					Vegetated Wetlands				Water Bodies					Shore Land			Shore Land		
	Mudflat	Sand	Beach	Shoal	Rocky Coast	Man-groves	Beach veg.	Beach plant	Other Veget.	Estaury	Lagoon	Kayal back water	Creek	Water body	Coastal dune	Coastal dune with veg	Paleo flats	Salt pan	Aqua. ponds	Islands
Kali	1032.50	7.5	337.5	20.0	125.00	37.5	2.5	27.5	32.5	1395.00	-	227.5	-	-	262.5	-	-	67.5	-	110.0
Belekeri-tadri - Gangavalli	354.50	10.0	267.5	22.5	12.5	57.5	-	-	27.5	267.5	12.5	-	205.0	-	-	1545.0	-	1212.5	5.0	42.5
Aghnashni - Sharavathi	1587.5	10.0	47.5	42.5	-	85.0	-	-	357.5	2883.5	-	-	90.0	-	347.5	155.0	-	415.0	242.5	450.0
Venkatapur	160.0	-	330.0	-	47.5	17.5	10.0	-	15.0	60.0	10.0	-	17.5	-	-	-	-	-	-	147.5
Shiroor-Baindoorhole	102.5	-	394.5	-	-	80.0	-	-	2.5	372.5	30.0	-	77.5	-	-	20.0	-	-	-	-
Chakrahaladi Kollur	427.5	7.50	412.5	52.50	-	312.50	5.0	-	12.50	1805.0	485.0	-	-	-	-	155.0	-	-	-	495.0
Sita - Swarna - Kodi - Udiyavara	67.5	-	530.0	40.0	-	77.50	-	-	10.00	1705.0	-	-	-	-	35.0	-	-	-	-	428.5
Mulki - Pavanje	107.5	7.5	377.5	10.00	--	125.0	5.0	10.0	5.0	455.0	-	35.0	87.5	7.5	42.5	-	15.0	-	-	-
Gurpur - Netravathi	97.5	480.0	516.2	100.0	-	22.5	5.0	152.5	57.5	2078.5	37.5	335.5	45.0	92.5	-	-	-	-	-	297.5
Total	3937.0	522.50	3213.20	287.50	185.00	815.00	27.50	190.00	520.00	11022.0	575.0	597.5	522.5	100.0	687.5	1875.0	15.0	1695.0	247.5	1971.0



tures. These plantations while being commercially remunerative can cause great harm to the biodiversity and habitat of the *flora* and *fauna*. A proper land use plan has to be evolved to preserve original forest communities, habitat and animal corridors. The loss of rich *fauna* including the gaur, elephant, tiger and other unique wild life species would be regretable.

Water: Water is essential for human communities and for industrial activity. After use it is discharged as an effluent on land, into water bodies, rivers and the sea. Unless purified to required standards it can contaminate land, river and sea.

The greatest water pollution in Karnataka is caused by urban agglomerations. There are 172 municipalities under the jurisdiction of the Karnataka Urban Water Supply and Drainage Board (KUWSDW). The Bangalore Urban Agglomeration has a separate board - The Bangalore Water Supply and Sewerage Board (BWSSB). The former supplies 642.8 million litres per day (MLD) while the latter supplies 423 MLD. This will increase by 270 MLD when the Cauvery Stage III is implemented. Out of the 1,065.82 MLD supplied to Urban areas 80% i.e. about 852.65 MLD is discharged after use.

It is obligatory on the authorities to treat this sewage up to the secondary stage at least, before discharging it. However 139 of the 172 municipalities do not have functional underground drainage or sewage treatment plants. The BWSSB has only one functional treatment plant at K & C valley while the Hebbal and the Vrishabhavathi plants are not yet functional.

Industrial effluents: Industrial effluents can cause organic, chemical and even hazardous pollution. In order to control this pollution, effluent standards have been prescribed industry wise and also depending on the point of discharge e.g., land, enclosed water bodies, flowing water, sea etc. Thermal pollution caused by water with temperatures above the ambient water temperature is also to be controlled. The Water (Prevention and Control of Pollution) Act, was enacted by Parliament on 23 March 1974.

Air: Stack emissions from industries also emit fumes containing both suspended particles as well as obnoxious gases. Stack emissions are to be controlled and have to conform to standards using devices like cyclones, scrubbers, electrostatic precipitators and similar devices. The resultant particulate matter gives a sludge which again has to be disposed of. The Raichur Thermal Power plant produces around 3,000 tonnes of ash a day. The Mangalore Super Thermal Power Plant is estimated to generate 20,000 tonnes of ash per day when in full operation. Ways have to be found and implemented to use this ash in down-stream useful products like bricks, cement, etc.

Another step towards controlling pollution and protection of our environment was taken by the enactment of the Air (Prevention and Control of Pollution) Act, 1981. Since air pollution is a transboundary phenomenon, the standards for air quality have been determined by the Central Pollution Control Board. Monitoring and enforcement are the responsibility of the State Boards.

Noise pollution caused by 1) Industrial Noise 2) Traffic Noise and 3) Cultural Noise is also under the purview of this Air (Prevention and Control of Pollution) Act of 1981.

Environment Protection Act

More comprehensive legislation to provide for the protection and improvement of the environment was enacted and termed the Environment (Protection) Act on 23 May 1986. Proper location of industries, procedures for preventing accidents, handling hazardous substances, inspection of industrial premises and taking up of remedial measures are covered by this Act.

Sanctions provided under the Act are closure of the offending industry, stoppage or curtailing of electricity, water supply or any other service in case of default. The penalties under this Act cover not only offending industries in the private sector but also Government Departments and their heads. "When an offence is committed by a Government Department, the head of the said department shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly"(Art. 17, Sect.1 of EPA). Protection is however afforded to Heads of Departments if they can prove that the offence was committed without their knowledge or that all due diligence was exercised to prevent commission of such offence.

All large and medium industries have to obtain clearance even before setting up of the industry. The Environment Clearance Committee of the Govt. of Karnataka meets every month in Bangalore to scrutinise industrial project proposals. The Chief Inspector of Factories, The Pollution Control Board, The Directorate of Industrial Development, The Department of Health, The Social Welfare Board and environmental experts are represented on this Committee.

Industries have been categorised according to their size, nature of their raw materials and toxicity of the effluents or emissions. Of special interest is the identification of 18 categories of highly polluting industries by the Central Pollution Control Board. A time-bound programme has been set up to achieve results. Karnataka has 138 units coming under these 18 categories. These have again been placed in 3 groups. The first group includes those units which have already installed pollution control measures to conform to pre-

scribed standards. The second group is made up of industries which have initiated control measures. Time is given to them up to 31st Dec,.1993 to achieve the prescribed standards. Closure orders are being issued to these industries according to procedures prescribed by the Acts with their Rules. An Appellate Authority consisting of three members has also been set up to permit redressal in case the industry considers it has not been given a fair deal by the enforcing authorities under the Water, Air and Environmental Protection Acts. There have been instances where offending industries have been given a shock when water and power have been cut off. Even when stay orders are issued by the courts, time bound commitments are obtained under the law.

Large industries storing, using or producing hazardous materials have to prepare on site and off site emergency plans. The District Authorities are closely involved in the "off site" emergency plans which have to conduct regular practice drills. Karnataka cannot afford a repeat of Bhopal disaster.

The legal measures detailed here are only part of the effort being made. Securing the co-operation of the industries is essential. Industrywise seminars, interaction with technical experts and environmental awareness among developers has led to a realisation that there can be no development without environmental protection. The days when industrialists looked only for profits and bulldozed all else are almost gone.

During the early stages of industrial development, the production was small and the waste large. Today factories are relatively small and the parallel treatment plants often large. We are already on the threshold of new integrated development where the wastes of one process become the raw material of another process. New technologies are therefore needed to minimise waste as well as to recycle it. The Environmental Protection Act enjoins Pollution Control Boards to promote the necessary research towards better technologies. The age of a no-waste technology might still be far away. Today the polluter is made to pay. A realisation that pollution control pays could herald a new era in the search for environmental excellence.

Last but not the least is the need for vigilance among groups of citizens. If the people are alert they have the chance of preventing harm and ensuring a better environment.