

## CHAPTER 1

### GENERAL

**D**harwad district has been an inhabited district since ancient times. Rivers like the Tungabhadra, the Varada and the Malaprabha have helped in the settlement of human population since pre-historic times. In the history of Karnataka, the role of Dharwad district is special, yet not even a single dynasty of rulers had its permanent capital in this district. However, historically famous and rich regions like *Belvola-300* and *Puligere-300* were fully incorporated in this district. As such Dharwad region was the core of many a kingdoms. Hence many centres of political, religious and educational activities had developed here. Thus many important temples were built in this district. Tanks and *agraharas* were also developed. Hence this district evolved as a lively centre of religious, cultural and financial importance.

Dharwad district lies in the catchment area of the Tungabhadra and the Malaprabha rivers. The soil has been formed due to the mixture of many types of disintegrated rocks. The two main types of forests in this region are *moist deciduous forests* and *thorn and scrub forests*. The climate of this region is comparatively good. The main profession of the people is agriculture. Many tanks and reservoirs of ancient times are useful even now. The main food crops are Jowar, Paddy and Wheat. Among the non-food crops, Cotton, Groundnut, Chillies, Sugarcane and Safflower are important. This district is famous right from the beginning for Cotton. Grapes of Dharwad, *jumblums* of Navilur, wild fruit (*bore*) of Vasana. Cashew and Mango of *Malnad* are also famous. This district is renowned for Cotton industry. Next to agriculture the main avocation is business. Hubli is the main business centre. The district has achieved tremendous progress in education. In the northern Karnataka region, Dharwad district is the centre of higher education. Many public and religious organizations have played an important role in the establishment of educational institutions in the district.

#### Location and Boundaries

Dharwad is one of the largest districts situated in the western sector of the northern half of Karnataka State. The district encompasses an area of 13,738 sq km. lying between the latitudinal parallels of 14°17' North and 15°50' North and the longitudinal meridians of 74° 43' East and 76° East. The maximum length of the district is 186 km. between Lakmapur of Nargund taluk in north to

Guddada Madapur of Hirekerur taluk in the south. The maximum width of the district is 138 km. between Timmapur of Gadag taluk in the east and Alnavar of Dharwad taluk in the west. This district which has the largest number of taluks (17), is bounded on the north by the districts of Belgaum and Bijapur; on the east by the districts of Raichur and Bellary; on the south by the districts of Chitradurga and Shimoga and on the west by the district of Uttara Kannada. The Malaprabha river flows in the north of the district for about 25 km. separating Dharwad district from Bijapur district. In the southeastern and the eastern sector, for a distance of about 130 km, the river Tungabhadra forms the natural boundary. In its shape, the district may be regarded as roughly resembling an inverted triangle; broad at the northern end and very narrow at the southern end. The eastern and the western borders gradually converge to a narrow strip as one moves from the north to the south. One special feature is that all the seven districts surrounding Dharwad district belong to Karnataka State.

### **Area and Population**

The total geographical area of Dharwad district is about 13,738 sq km. and is next to Bijapur, Gulbarga and Raichur in area. In the total geographical area of the State, the share of Dharwad district amounts to about 7.16%. According to 1991 Census, the population of the district is 35,03,150 (7.81% of State population) and it is next to Bangalore and Belgaum in district-wise population. Dharwad district comprises of 17 taluks, which are grouped into four revenue sub-divisions and 44 hobliies/ revenue circles. Dharwad sub-division has Dharwad, Hubli, Kalghatgi and Navalgund taluks; Savanur subdivision has Savanur, Shiggaon, Hangal, Shirhatti and Kundgol taluks; Gadag subdivision has Gadag, Mundargi, Ron and Nargund taluks while Haveri subdivision has Haveri, Ranibennur, Byadgi and Hirekerur taluks. Nargund taluk is the smallest having 3.17% (435.8 sq km) of the total area, while Ron is the largest taluk with 9.39% (1,290.6 sq km). The geographical area of the district is not evenly distributed among the 17 taluks. The geographical area of two taluks (namely Byadgi and Nargund) is less than 500 sq km. and that of four taluks (namely Dharwad, Gadag, Navalgund and Ron) exceeds 1,000 sq km. while in the rest of the 11 taluks it varies between 500 to 1,000 sq km. According to the 1991 Census, there were 1,366 villages in Dharwad district of which 22 villages were uninhabited. At the 1981 Census, there were 1,362 villages in the district including 40 uninhabited villages. The district has 22 cities/towns with 19 town municipal councils. The municipal jurisdiction of Hubli Dharwad Corporation straddles over the revenue areas of villages belonging to the taluks of Hubli and Dharwad. Table 1.1 indicates the taluk-wise details of the area, population, density of population and administrative units as per 1991 Census. The area of the district represents 'Geographical area' and has been furnished by the Surveyor General India. The total areas of taluks represent land use areas as furnished by the Director of Survey, Settlement and Land Records. Thus the total areas of all taluks do not correspond to the total area of the District.

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Note: Dharwad district has been reorganised into three districts viz., Dharwad, Gadag and Haveri vide Government of Karnataka Notification No. RD42 LRD 87 Part III Bangalore dated 2.8.1997. The details of area and population of the newly constituted districts are given at the end of this book.

Table 1.1 : Talukwise details of area, population, density and administrative units

Sl.	Name of Taluk	No. of Hoblies	Villages		No. of towns notified area	Town Municipalities and minutes committees	East Longitude in degrees and minutes		North Latitude in degrees	Area in sq km (100 s)	Total Population sq.km	Density per (1991)	
			inhabited	uninhabited			From	To					From
1	Byadgi	2	62	1	1	1	75.15	75.36	14.35	14.37	436.6	1,119	256
2	Dharwad	4	105	6	1	1	74.43	75.15	15.19	15.41	1032.5	1,928	187
3	Gadag	2	54	1	2	2	75.16	75.26	14.59	15.24	1097.4	2,899	264
4	Hangal	3	142	3	1	1	75.01	75.20	14.35	14.54	773.6	2,044	264
5	Haveri	3	86	2	1	1	75.18	75.46	14.42	15.00	779.9	2,205	275
6	Hirekerrur	3	124	3	1	-	75.14	75.37	14.19	14.36	806.6	1,920	237
7	Hubli	3	47	11	1	1	75.01	75.28	15.11	15.31	631.8	1,131	178
8	Kalghatgi	3	82	-	1	-	74.49	75.09	15.02	15.21	682.8	1,212	177
9	Kundgol	2	56	1	1	1	75.09	75.26	15.16	15.37	648.5	1,380	212
10	Mundargi	2	48	-	1	1	75.39	75.56	15.00	15.25	884.0	1,018	115
11	Nargund	2	33	2	1	1	75.05	75.34	15.21	15.41	435.6	867	199
12	Navalgund	2	58	-	2	2	75.16	75.35	15.39	15.51	1080.8	1,615	149
13	Ramibennur	3	103	3	1	1	75.29	75.50	14.24	14.48	907.0	2,693	297
14	Ron	3	91	-	3	3	75.30	76.02	15.31	15.52	1291.0	2,210	171
15	Savanur	2	62	-	1	1	75.05	75.46	14.51	15.05	539.0	1,237	229
16	Shiggaon	3	93	-	1	1	75.03	75.22	14.52	15.09	588.6	1,475	250
17	Shirhatti	2	76	7	2	1	75.24	75.45	14.57	15.17	949.2	1,597	168
18	H.D.C.	-	-	-	-	-	-	-	-	-	190.90	6,483	3,396
Total		44	1,322	40	22	19	74.43	76.02	14.17	15.50	13738.0	35,033	255

HDC : Hubli-Dharwad Corporation extends both to Hubli and Dharwad taluks. Hence it is shown as a separate unit and not under any taluks.

### The Origin of Name

The name 'Dharwad' is at least one thousand years old. The Kannada inscription of 1117 AD available in the Durga temple of the city makes a mention of the name 'Dharwad'. This was under the administrative unit of the then *Kundur-500*. According to epigraphical evidence, the *Kundur* administrative unit had Dharwad and many other villages. It is difficult to trace the deduction of its name. It seems Dharwad was the gateway for the collection of commercial toll for the transportation of commercial goods between *malnad* region and the plains. The name Dharwad, might have come from (being an entry point) *Dwara-Dara, vada-Bada*-village i.e., between two regions. In an inscription dated 1216 AD, Dharwad has been described as a town indicating its increasing prominence in those times. *Kalattur* inscription (Hubli taluk) belonging to the same period describes that it formed a part of the *Kampana* of Dharwad. According to a pillar inscription belonging to the Vijayanagar period Dharwad was an administrative centre. Dharwad having been situated on the main road, it is a link point between parts of southern and northern Karnataka. There is also an opinion that since Dharwad was a centre of weaving, it also had a name called *Tantupura* (*Tantu* meaning thread). Dharwad is situated in between plains (*Belavola*) and Hilly (*Malnad*) regions and it is the route to go to *malnad* from plains. It was called *Dwaravata*, which changed to Dharwad and ultimately Dharwada. During British times, Dharwada became Dharwar, and later as Dharawada only (according to Karnataka Government order dated 31st January 1977). Like many other districts of Karnataka, Dharwad district is named after its headquarters town.

### Territorial Changes

When Karnataka province was a part of Mauryan Empire, it is believed that Dharwad also was a part of it. During the rule of the Shatavahanas, Dharwad was under their administrative control. During the reign of the Kadambas, it is evident that the district was a part of the Kadamba Kingdom. The present town of Devagiri was perhaps their second capital known by the then name 'Tripurvata'. When Chalukyan kings came to power in Badami after the Kadambas, Dharwad district came under their control. During the same period, many who belonged to 'Sendraka' family have appeared as vassals of Badami Chalukyas as per some stone inscriptions. The Rashtrakutas ruled over the area after the Chalukyas of Badami. During the Rashtrakuta period, many administrative divisions were formed which included many villages (*Badas*). The main region which included parts of Dharwad district was *Banavasi-12,000*, *Basavur -140* (region including parts of Haveri Taluk), *Belahuge-70*, *Guttavolalu*, and other places of the same taluk like *Neeralagi*. *Bennayur-12* was the region surrounding the villages of *Motebennur* and belonged to Ranibennur taluk. *Chinchalagi-50* had a main village *Chinchali* belonging to Gadag taluk. *Hichagenadu* included *Hiriyakittur* and *Ichhanggi* of Haveri taluk. Villages like Itagi of Ranibennur and *Rattihalli* of Hirekerur included *Ittage-30* and *Rattapalli -70* and formed a region called 'Noorumbada'. *Kaginele -12* was a province that included the surroundings of *Kaginelli* village. The main village of Kolanuru-30 was *Konnur* of Nargund taluk. *Paanungallu -500*, *Belvola 300*, *Puligere-300* were regions spread in the greater parts of the district. The village *Narendra* near Dharwad was one of the centres of *Kundur-500*. *Narayangallu -12* was a part of present Ron taluk. In these provinces, many vassals and other small subordinate Chieftains were ruling.

During the period between the tenth and the twelfth centuries, Dharwad district was a part of the Kalyana Chalukyan Empire. The Kadambas of Hangal, the Guttas of Guttal, the Sindhas of Rattihalli, the Kadambas of Goa, the Sindhas of Yalaburga and the Kadambas of Noorumbada ruled in different parts of the district as vassals of the Kalyana Chalukyas. After the Kalyana Chalukyas, many vassals

of this region supported Bijjala of Kalachuri. Subsequently, the district came under the control of the Hoysalas and the Seunas. The district often used to get divided between these two rulers. After the establishment of the Vijayanagar Empire, there was a competition to take control of the district. The Bankapur region of the district often changed hands. When Yusuf Adil Shah of Bijapur started ruling independently (1489), many parts of the district came under his control. Even during the time of Krishnadevaraya and subsequent rulers, major parts of the district were under their control. Beginning from 1573, for over a century, the district was under the Sultans of Bijapur. A few parts of the district also came under the rule of Shivaji and his son Sambaji and later in 1586 were transferred to the Mughals. In 1686 when Bijapur was annexed into the Mughal Empire, Savanur was made the centre of district administration. During the same period, Navalgund, Shirhatti, Havanur and Dambala were administered by the Desais. During 1719, Marathas obtained the right of collecting taxes like '*chowtai*' and '*sardeshamukhi*'. In this manner the district was exposed to the activities of the Marathas. During the period between 1720-1818 many Maratha chieftains ruled the district under the control of the Maratha Peshwas. At the same time many parts of the district were under the control of the Nizam of Hyderabad. The Nawab of Savanur under the tutelage of the Mughals became a significant and powerful ruler. During the same period, Haider Ali and Tipu Sultan constantly attacked the district and had taken control of Savanur and other places. In 1791, after the defeat of Tipu, the district came under the control of the Marathas. British rule was started from 1818. Many places like Nargund, Sangli, Mirji, Jamkhandi and Savanur were under the control of subordinates of the British.

According to the decision of the directors of the East India Company, Dharwad district was created in 1830 and was included in the Bombay Province. The then Dharwad district included not only the present district but also certain places of other districts like Belgaum, Bijapur and Sholapur. Belgaum district got separated in 1836. During 1857-58, under the leadership of Babasaheb of Nargund and Mundargi Bhimrao, there was a rebellion. After that incident British administration got entrenched in the district. Many villages of Nargund region came under the control of the British. These regions came under the British administrative system giving a fillip for English education and other related activities.

Even though Dharwad district was an administrative unit under the Bombay Presidency, many parts of the Maratha Provinces and Savanur State were also included in the district. Details of villages included under the district on August 1st 1949 were: 17 villages and three towns from the former Jamkhandi State; 15 villages and two towns from the former Senior Miraj; 14 villages and one town from the former Junior Miraj, 72 villages and one town from the former Sangli State; 7 villages of the former Ramdurg State and the entire State of Savanur. At the same time three villages of the district were transferred to Ramdurg Taluk and four villages to Hyderabad State. 12 villages from Hyderabad State were added to Dharwad district. In 1962 Hubli and Dharwad towns were combined and regarded as a city Corporation. In 1969, 36 villages of Haveri taluk and 37 villages of Shiggaon taluk were merged to form Savanur taluk. The district of Dharwad is included in Belgaum Revenue division. For purposes of administration each taluk is divided into number of revenue circles comprising a certain number of villages. A revenue village is the lowest revenue administrative unit. Details of the number of villages in the *hoblis* of Dharwad district are given in table 1.2 as per the census of 1981.

**Table 1.2 : Details of hobliwise number of villages in Dharwad district**

Sl.No.	Name of the Taluk	No.of Villages		Name of the Hobli	No.of Villages	No.of Towns
		According to Revenue & Land Records	According to 1981 census			
1	Byadgi	63	63	Byadgi	28	1
				Kaginelli	35	-
2	Dharwad	133	111	Dharwad	22	1
				Alnavar	29	-
				Garag	36	-
				Amminbhavi	24	-
3	Gadag	57	55	Gadag	26	2
				Betgeri	29	-
4	Hangal	146	145	Hangal	46	1
				Bommanahalli	48	-
				Akki Alur	51	-
5	Haveri	88	88	Haveri	27	-
				Karjagi	30	-
				Guttal	31	-
6	Hirekerur	128	127	Hirekerur	44	1
				Hamsabhavi	36	-
				Rattihalli	47	-
7	Hubli	66	58	Hubli	14	1
				Shiraguppa	44	-
8	Kalghatgi	86	82	Kalghatgi	25	1
				Dhumwad	31	-
				Tabakada Honnahalli	26	-
9	Kundgol	57	57	Kundgol	31	1
				Saunshi	26	-
10	Mundargi	51	48	Mundargi	23	1
				Dambal	25	-
11	Nargund	35	35	Nargund	20	1
				Konnur	15	-
12	Navalgund	59	58	Morab	27	2
				Annigeri	31	-
13	Ranibennur	106	106	Ranibennur	33	1
				Kuppelur	41	-
				Medleri	32	-
14	Ron	95	91	Ron	32	3
				Naregal	32	-
				Hole Alur	27	-
15	Savanur	62	62	Savanur	33	1

Sl. No.	Name of the Taluk	No. of Villages		Name of the Hobli	No. of Villages	No. of Towns
		According to Revenue & Land Records	According to 1981 census			
16	Shiggaon	91	93	Hattimattur	29	-
				Shiggaon	22	1
				Bankapur	38	-
				Dundashi	33	-
17	Shirhatti	83	83	Shirhatti	44	2
				Lakshmeshwar	39	-
District Total		1,406	1,362	-	1,362	22

The list of revenue villages included at the time of merger is given here under.

- a) Villages added from Jamakhandi State to Kundgol taluk of Dharwad district. 1. Kundgol, 2. Majipura 3. Majikadapatti, 4. Majiallapur, 5. Betapur, 6. Devanur, 7. Kubihal, 8. Yalival, 9. Vithalapur, 10. Shirur, 11. Kammadolli, 12. Manasali (Becharak village) 13. Nelagudda, 14. Hanchinala, 15. Inamkoppa and 16. Gudenakatti.
- b) Villages added from Sangli State to Shirhatti taluk, 1. Shirhatti, 2. Khanapur, 3. Ranatur, 4. Devihal, 5. Tegginabhavanur, 6. Navebhavanur, 7. Bhavanur, 8. Machenahalli, 9. Nagaramadavu, 10. Tangoda, 11. Majjur, 12. Kusalapur, 13. Chabbi, 14. Kadakol, 15. Jalligeri, 16. Vadavi, 17. Bellatti, 18. Narayanapur, 19. Chikkasavanur, 20. Sasaravad, 21. Tolali, 22. Kalliganur, 23. Chowdal, 24. Kanakavad, 25. Itagi, 26. Basapur, 27. Kerehalli, 28. Tarikoppa, 29. Alagavadi, 30. Belagatti, 31. Hosur, 32. Hulluru, 33. Nelogal, 34. Amarapur, 35. Bannikop, 36. Sugganahalli, 37. Hadagali, 38. Yelavatti, 39. Madalli, 40. Yatnalli, 41. Gojanur, 42. Akkigund, 43. Magadi, 44. Halalapur, 45. Parasapur, 46. Adrakatti, 47. Haradagatti, 48. Hiremallpur, 49. Battur, 50. Shettigeri, 51. Sankadal, 52. Nadigatti, 53. Adralli, 54. Nogival, 55. Kokkaragundi and 56. Boodihal.
- c) Revenue villages included originally in Senior Miraj province and added to Shirhatti Taluk- 1. Hirebana, 2. Pethabana, 3. Bastibana, 4. Huligeribana, 5. Desaibana, 6. Wodeyar Mallapur, 7. Shigli, 8. Doddur, 9. Ullatti, 10. Shyabal, 11. Undenahalli, 12. Ramageri and 13. Ankali,
- d) Revenue villages originally in Junior Miraj and later included in Shirhatti taluk 1. Hebbal, 2. Yellapur, 3. Balehosur, 4. Govinal and 5. Gulagunjikop.
- e) The following villages of Yelaburgi taluk of Raichur District have been transferred to Ron Taluk. 1. Itagi, 2. Mugali, 3. Shantageri, 4. Honniganur, 5. Tallihal, 6. Gulaguli 7. Hire-Alagundi, 8. Chikka Alagundi, 9. Bommasagar, 10. Sarjapur, 11. Belagod and 12. Yerekadambanal. Guddada Mallapur has been transferred from Raichur district to Byadgi taluk.

Among the 25 villages of Savanur State, the following villages were added to Shiggaon taluk in 1949. These are Basavanakop, Chillur, Chikkamanikatte, Savanur, Jekinakatte, Madapur, Nandihalli, Neeralakatte, Torur, Hotanahalli, Tondur, Vaddinakop, Naikerur, Gabbur, Kabanur, Surapagatti, Yakkikop, Mannur, Chandapur, Mulageri, Hulikatte and Honnikop. The remaining villages Dombaramatturu, Siddapur and Kalinala have been added to Haveri Taluk.

When Savanur taluk was created in 1969 (4th December 1969) 37 villages from Shiggaon taluk (Savanurpet, Savanur rural, Savanur urban, Yalavigi, Chillur, Chavadal, Chillur Badani, Allipur, Huralikopp, Challala, Tondur, Kurubara Mallur, Mannangi, Nelligatti, Halasur, Kunimellihalli, Melligatte, Kallamadavu, Baradur, Chikkaboodihal, Mahur, Tevaramellal, Fakiranandihalli, Savur Nandihalli, Mannur, Teggihalli, Neeralagi- M Karadagi, Gundur, Mantrodi, Jekinakatte, Karadagi, Madapur, Gonal, Hoovinashigli, Honnikoppa, Vaddinakop, Basavanakop and Naikeruru) and 26 villages from Haveri Taluk (Bevinanhalli, Tallihalli, Hosahalli M Karadagi, Hattimattur, Kadakol, Hesarur, Shiddapur, Kalival, Byrapur, Icchangi, Krishnapura, Ichala yellapur, Chikkamaralihalli, Hiremaralhalli, Kamalabangadi, Timmapura, Dombara mattur, Hiremagadur, Neeralagi M Karadagi, Kalkote, Aralihalli, Chikkamagadur, Mantagani, Kalasur, Jallapur, Kalalakond and Shirabadagi) were added to the new taluk.

Kamadolli, Kundgol and Saunshi, belonging to the Jamakandi State which were towns according to 1951 Census and Yelawal which was a town according to 1911 Census, are in Kundgol taluk. Gudgeri in Junior Miraj which was a town, till 1951 is also in Kundgol taluk. Shigli belonging to Senior Miraj State and which was a town till 1951 and Lakshmeshwara, which is a town even now, and Shirhatti town of Sangli State are in Shirhatti taluk.

### Topography

This district, which is inclined from west to east, is divided into western hilly region and eastern plains. The narrow region between the two is the frontier area.

**Malnad (Hilly Region):** This includes undulating and often parted western ghat region. This region occupies approximately one third of the area of the district. The *malnad* region or the *Sahyadri* region is about 25 to 30 km. wide in the western region of the district and includes areas of Dharwad, Kalghatgi, Shiggaon, Hangal, Hirekerur and Ranibennur taluks. Among the hills of this region, *Tegur* hills in the east of Alnawar, *Kadur* hills, *Boodanagudda* located between Dharwad and Kalghatgi and *Ganigudda* to its west are important. *Boodanagudda* is about 13km. long and 1.6 km. wide and is spread in the north south direction. This is about 152 m. higher than the surrounding areas. There are two peaks which are 745 m and 719 m high (above the mean sea level). The *Dhundasi* and the *Hangal* hills are smaller and roundish in shape. In the south apart from the *Kadur* hills, there are also the *Masur* and the *Maravalli* hills. These are steep and spread in the east west direction. The average height of these is 732 m above mean sea level. The tallest peak is 825 m high.

**Frontier:** The frontier area between the *Malnad* and the plains is about 32 km. wide. The western borders of this are Tegur, Tadasa, Shiggaon and Koda. Eastern boundary - Dharwad, Hubli, Karjagi and Ranibennur. Pune-Bangalore National Highway passes through this region. In this region Airani hill is located near Ranibennur and Devaragudda to the east of Byadgi. Many areas of Dharwad, Hubli, Kalghatgi, Kundgol, Savanur, Shiggaon, Haveri, Hirekerur and Ranibennur are included in this region.

**Plains:** The plains, also called *Belavalanadu*, lying to the east region of the frontier, are made up of undulating terrain. Here the important hills are the *Gajendragad* hills, the *Nargund* hills, the *Navalagund* hills and the *Kappatgudda*. The *Kappatgudda* is spread to a length of 48 km. to the northeast of Gadag. This is about six km. wide at either ends but 16 km. wide at the centre. This consists of many parallel hill ranges which have an average height of 122 m when compared with those in the surrounding areas. The highest peak in this range has a height of 937 m above the mean



sea level. This hill starts as a single range and branches out into 3 to 4 parallel ranges near Dambala and further down continues as a single range towards Tungabhadra River. The plains are also called "Yerenadu". The regions included in this area comprises the eastern portions of Dharwad, Haveri, Hubli, and Ranibennur taluks and Kundgol, Navalgund, Nargund, Ron, Gadag, Mundargi and Shirhatti taluks.

**Hills** : The district has five important hill ranges viz. *Boodanagudda* range to the west, *Airani* range to the north west, *Kappatagudda* range to the east and the remaining two ranges without specific names. In addition, small hillocks are spread here and there in the district. Sand stone hillocks of *Navalgund*, *Nargund* and *Chikkanargund* to the north are important.

#### GEOLOGY

To the north east of the district is spread sandstone belonging to Kaladagi rock ranges. This is also found at the top of Nargund and Navalgund hills. Laterite rocks are found in different parts of the district, specially so in the western parts of the district. Rocks belonging to Dharwad rock strata are found mainly in the central, western and southern parts of the district. Near Doni village is found a vast spread of limestone. Granite and gneiss rocks are usually found in the plains.

**Dharwad Rock Formation** : The geological name for the crystalline schist near Dharwad is 'Dharwar System', the name being given by Robert Bruce Foot (1886). This is formed by lava, dust and other particles of volcanic origin and is made up of sedimentary rocks. This sedimentary system was believed to have been formed after granitoid gneiss rocks broke upon due to tectonic changes resulting in disturbance of sedimentation and formation of metamorphic rocks. Subsequently research were carried out and it was concluded that conglomerates, sand stones, lime stones and some types of sedimentary rocks had been confirmed to be metamorphic rocks. There are four types of rock system in this rock formation.

(a) Igneous rocks, (b) Crystalline sedimentary rocks (c) Disfigured sedimentary rocks and (d) Incrusted Igneous rocks. The rocks of Dharwad schists are spread in north south direction as bands in different sizes. Surrounding this are found granite and gneiss rocks.

One group of western sedimentary rock system originates a little north of Dharwad and spreads in a southward direction up to the banks of the Cauvery river. The Ranibennur group of Dharwad rock formation is developed very well in Dharwad and Uttara Kannada districts and has more of gravel and chlorite phyllites. The bases of these rocks are less disturbed and have only small cracks.

**Kaladagi Formation:** This includes aqueous rocks spread between the gneiss regions of Dharwad, Belgaum and Gulbarga districts and the lava region, which is spread in the northern plateaus of the state. This represents a fossilless iron mixed rock formation deposited on ancient gneiss and Dharwad sedimentary rocks. This formation is found in Nargund and Navalgund taluks of the district and has granite, limestone and clay.

**Mineral Deposits:** The eastern part of the district has ancient granite and sedimentary rocks. Two parallel rocky structures that rise in the central part of the district form the base for the Dharwad sedimentary rock formation. This is formed due to the combination and metamorphosis of Igneous and aqueous rocks. Piercing this, have arisen granite and gneiss rocks. This kind of geological formation is very complex; Dolerite rocks including granite, basalt, Dharwad sedimentary rocks and lime stone

have spread in all directions. The north eastern part of the district has sandstone belonging to Kaladagi series. Manganese is one of the important metals. Manganese ore is mainly used in the manufacture of Iron and steel, to acidify sulphur and phosphorous for purification and also for the manufacture of different grades of manganese steel. Much of the manganese ore deposits are in the central and northern part of the state and are found in the Dharwar sedimentary rock formation. There are small low-grade manganese ore deposits of 28 to 38% in the district. This deposit has been found in *Chikkavadavalli* valley. There are also reports of the presence of deposits in the *Kappatagudda* region and to the south of Hemmige. Pyrites is found in Koratur and Jalligeri.

Iron ore is found mostly in the *Kappatagudda* range. Even though gold deposit is found in the *Kappatagudda* range, it is not economically viable since it is very thin. Haematite deposits are also found in sediments and iron ore mixed granite layers in small quantities but these deposits are not economically viable. In Doni river which flows from *Kappatagudda*, copper ore is found here and there but this is not to the extent for profitable extraction of copper. Granite and gneiss rocks are removed from quarries for use as pillars, stone slabs, *Jalli* etc. In these rocks, quarrying is easy due to the presence of natural cracks, which can be used for breaking them in desired shape and size by heat treatment. In Mundargi, Baradur, Magadi and other places of the district quarrying is done to extract granite slabs. This is used as foundation stones, as rolling stones, masonry stones, and also for laying metal roads. Stone slabs, which are used for roofing as well as floor laying, are removed from layered rocks found near Binkadakatte, Mallasandra, Malkote, Bedagatta and Mandavad of the district. Near Doni village, lime stones of mixed nature of green and ash colour are spread to an extent of 1.5 km. long and 15 m wide. Layers of similar nature are found near Dindur also. It has been estimated that these deposits have about 2.5 lakh tonnes of limestone. Even though there are some yellow brown China clay deposits near Masur, they are not economically viable.

**Ground water resources:** Rain water falling on the soil (to the extent of 4 to 20%) percolates into the soil layers, flows deep down and gets collected in the crevices, breaks, faults and cracks and comes out when they are full. Ground water is available largely in sequestered igneous and metamorphic rocks and also in the cracks and openings of other types of rocks. Top soil of the Delta region that helps in the storage of underground water is very less in this district. In places where basaltic flow is closed and in places where weathering of rocks has taken place, underground water is available. The quantity of underground water depends on the structure, type and extent of rocks and is available in plenty where soft rocks are located and available in less quantity where rocks are hard. Underground water can be traced by geological and geophysical surveys. Many ancient methods are also employed to identify underground water. For example, there are instances of the presence of underground water where ant hills, Oleander, Bombax, Fig and neem trees are present. Dharwad district has an annual renewable ground water source of about 1,24,882 hectare metre (ham), of which up to 1.1.1991, only about 23% (24,392 ham) has been exploited and 77% is still unexploited. Before independence farmers themselves with their own resources used to dig wells and arrange lift irrigation, Persian wheel, *kapile* and such other water lifting methods. After independence enough importance has been given to well irrigation methods and the Department of Mines and Geology has been helping farmers who want to use pumpsets and dig wells to obtain underground water. For this purpose co-operative and banking sectors have been advancing loans. In recent years however traditional water lifting methods and diesel pumpsets are losing their importance and electrically operated irrigation pumpsets are gaining prominence. The State Department of Mines and Geology has undertaken a number of surveys to unearth groundwater and has been publishing reports about the availability of water. Based on the

present quantum of water already exploited, taluks have been classified into white area (less than 65% usage), grey area (between 65% to 85% usage) and black area (more than 85% usage). Table 1.3 indicates details of total annual water recharge (ham), net annual water recharge (ham) and level of utilisation.

**Table 1.3 : Groundwater resources and utilization in Dharwad District**

Sl. No	Name of Taluk	Total Annual recharge (ham)	Net annual recharge (ham)	Net annual utilization as on 1.1.83	Percentage utilization level	Percentage annual increase	Net annual utilization as on 1.1.87	Percentage utilization level	Net annual utilization as on 1.1.91	Percentage utilization level	Classification of taluk
1	2	3	4	5	6	7	8	9	10	11	12
1	Byadgi	4,738	4,027	753	18.7	2	1,075	27	1,383	34	White
2	Dharwad	12,134	10,314	323	03	2	1,148	11	1,458	14	"
3	Gadag	8,322	7,074	694	10	2	1,260	18	1,308	18.5	"
4	Hangal	14,679	12,477	141	1	0.5	391	3	1,602	13	"
5	Haveri	8,361	7,107	572	8	2	1,141	16	2,470	35	"
6	Hirekerur	10,131	8,611	1093	13	2	1,782	21	2,449	28	"
7	Hubli	4,302	3,657	245	7	2	538	15	935	26	"
8	Kalghatgi	10,122	8,604	68	1	0.5	240	3	779	9	"
9	Kundgol	6,409	5,448	69	1	0.5	178	3	110	2	"
10	Mundargi	4,541	3,860	697	18	2	1,006	26	1,610	42	"
11	Navalgund	5,698	4,843	30	1	0.5	127	3	407	8	"
12	Nargund	2,697	2,292	112	5	2	295	13	499	22	"
13	Ranibennur	6,610	5,619	1352	24	2	1,801	32	3,647	65	Grey
14	Ron	7,800	6,630	835	13	2	1,365	21	2,584	39	White
15	Savanur	3,980	3,383	501	15	2	772	23	915	27	"
16	Shiggaon	5,540	4,709	360	8	2	737	16	793	17	"
17	Shirhatti	8,818	7,495	498	7	2	1,098	15	1,443	19	"
District Total		1,24,882	1,06,150	8343	8	2	14,954	14	24,392	23	"

#### WATER RESOURCES

The district is drained by two major river systems namely the Malaprabha in the north and the Tungabhadra in the south. The Tungabhadra river system covers about one third of the total area of the district. The main rivers of Dharwad district are the Tungabhadra, the Malaprabha, the Varada, the Kumudvathi and the Bedthi. Even though the rainfall in this district is scanty, the rivers that originate in Western Ghats flow here and as such water resources are plenty and the land adjoining the rivers are fertile.

**The Tungabhadra:** Originating in the Western Ghats and flowing towards north-east are the rivers Tunga and Bhadra which join together near Kudli, 16 km. north-east of Shimoga. Thereafter the Tungabhadra flows in a northwardly direction until it leaves Shimoga District. The river bisects Raichur and Dharwad districts to its left, Chitradurga and Bellary towards the right. It further flows in Andhra Pradesh for a little distance. Within Dharwad district, the river flows a little distance to the north-east and from there, the river forms the eastern boundary for the district, separating it from Chitradurga and Bellary. The river starting from Shankaranahalli, meandering to the north, gets into the district a little east of Haveri and flows to the north via, Havanur. Further down, it borders Shirhatti Taluk and flows towards east and then to the south of Mundargi Taluk. Later it flows in northeasterly direction. It enters Bellary district in the eastern side from Hesarur in Dharwad District. *Hirehalla*, *Alurhalla* and *Shirhattihalla* join the Tungabhadra river, drain the Gadag-Mundargi region, the Gadag-Ron tract and south western parts of the Kappatagudda range respectively. The river flows further into Karnool district of Andhra Pradesh and a little ahead of Karnool town, it joins the Krishna River.

The river that flows for about 150 km. in the borders of Dharwad district helps in the irrigation of Ranibennur, Haveri, Shirhatti and Mundargi taluks on its left bank. The river traverses a distance of about 403 km. in the geographical limits of Karnataka State. From Kudli till it reaches the border of Bellary district the river flows deep down between high and steep banks. The width of the river is about 100 to 200 metres and the river traverses a rocky terrain. Here and there deep lagoons and whirlpools are common. Even though the Tungabhadra is a perennial river and has water throughout the year, the quantum of water flow during the summer is minimal. The river water is used for agricultural purposes to an adequate extent. Because of steep rocky shore up to Bellary, there are no dams in this region. Across the river, there is a rail bridge of Hubli-Bangalore railway and Road Bridge near Harihar. There is one more road bridge in Haveri – Harapanahalli route near Havanur. *Galaganath* and *Chaudadanapur* are the two important pilgrim centres of the district located on the banks of Tungabhadra.

**The Malaprabha:** The Malaprabha River flows in the north of Dharwad district and divides Bijapur and Dharwad district for about a distance of 25 km. and then flows towards the east. The Malaprabha is a tributary of the Krishna River, and has other names like- *Malapaharini*, *Malapahari* and *Malini*. This river originates in Kanakumbi of Sahyadri peaks of Belgaum. The river flows in Belgaum district and then becomes a border river between Bijapur and Dharwad and ultimately joins Krishna River near Kudalasangama in Bijapur district. The river enters the district near Lakmapur of Nargund taluk and then flows in a northeasterly direction in Ron taluk and enters Bijapur district near Hadagali village of Ron taluk. The *Bennehalla* which is a tributary to this river, joins near Holealur. This tributary originates near Dhundasi village of Shiggaon taluk and flows for about 192 km. in northerly direction in the taluks of Hubli, Navalgund and Ron. It joins the Malaprabha near Menasagi. Another rivulet the *Tuparihalla*, which joins the *Bennehalla* to the northwest of Navalgund, first enters the taluk from the west, then flows in an easterly direction, and turns south near Algawadi. Another rivulet the *Handiganahalla*, enters near Kittur to the southwest of Navalgund and flows to the north in the eastern part of the district joins the *Bennehalla* near Tadahala village. The *Pinjarahalla* another small rivulet joins the *Handiganahalla* near Tuppadakurahatti. A number of streams join these rivulets during the rainy season. The Hirehallu flows in a northern direction in Gadag and Ron taluks and joins the Malaprabha near Beleri. The total length of the Malaprabha is about 330 km. Navilutirtha dam of this river provides water for agriculture in the taluks of Navalgund, Nargund and Ron. There is a railway bridge over the river near Hole Alur, on the Gadag-Bijapur railway line.

**The Kumudwati :** The Kumudwati River originates in Agastyaparvata near Humcha of Shikaripur taluk. The river flows to the north *via* Kumsi and Shikaripur and enters Hirekerur taluk before joining the Tungabhadra river near Mudenur. This river is also known by the name *Joradi*. The total length of the river is about 96 km. The River flows through Ranibennur and Hirekerur taluks of Dharwad district for about 32 km. to the east and then joins the Tungabhadra river. This river is the lifeline of Madaga tank in Masur.

**The Varada :** Varada river, which is a tributary of the Tungabhadra, originates near Ikkeri and flowing through Sorab Taluk, towards north of Hangal taluk constitutes a boundary between Shimoga and Dharwad districts and enters Dharwad district near Honkana. This river flows in a northeasterly direction in Hangal taluk, and further down becomes a border between Haveri and Savanur taluks. From there it flows towards east in the northern part of Haveri Taluk and finally joins the Tungabhadra river near Galaganath village to the north of Havanur. The total length of the river is 185 km. of which the length of the river within the district is 101 km. The Dharma is an important tributary, which flows for a distance of about 32 km. in Uttara Kannada and Shimoga districts and further down in Hangal taluk of Dharwad district traverses for about 56 km. towards the north east of Hangal and it joins Varada River near Kudal. Many streams that flow during rainy season also joins the Varada river. The Varada is a perennial river. Even though there may not be much water in the river, many dams and barrages have been built across the Varada and the Dharma to provide water for irrigation.

Banavasi, Kudali and Galaganath are pilgrim centres located on the banks of this river. According to the legend, Shiva in order to cleanse himself of Brahmahatya sin was in penance at the originance of Varada river, which had the hermitage of Shringarishi'. The fire of penance that arose from Shiva at that time threatened to burn even the inhabitants of Swarga. Narayana brought Bhagirathi water in his '*conch*' and poured it on the head of Shiva which ultimately became the Varada river.

**The Bedthi :** While all the rivers and streams of Dharwad district flow towards the east and join Bay of Bengal, Bedthi alone flows towards the west. The Shalmala, which originates in Someshwara near Dharwad is a tributary of the Bedthi. The Bedthi originates in Dharwad taluk itself. The Shalmala joins the Bedthi in Sangedevarakop near Kalghatgi. This is also called the Gangavali river in Uttara Kannada. A barrage has been built across Bedthi near Dummavad and a tank called 'Neerasagar' has been constructed. Water from this tank is used to supply drinking water to Kundgol and Hubli-Dharwad cities. Nearly two thirds of the Dharwad district form the catchment area for the Malaprabha and its tributaries. The remaining one third is the catchment area for the Tungabhadra and its tributaries. Very little is the catchment area of west-flowing Bedthi and its tributary, the Shalmala. In the western margin of the district, a small tract of land is drained westwards towards the Arabian Sea, by the Shalmala river.

**Tanks :** Dharwad district has numerous tanks. In the western belt, tanks have been formed by constructing bunds across the shallow valley basins whereas in the drier eastern sector, the tanks are usually scooped out hollows such as stone quarries which serve as storage tanks for the rain water. According to the revenue records of 1858, Dharwad district had more than 3,150 irrigation tanks, of which 535 were major irrigation tanks, each one of which were meeting the irrigation needs of more than 50 acres of land. There were also huge irrigation tanks which irrigated more than 500 acres and they included, Doddakere, B.Konanakeri, Bankapur taluk – 654 acres; Heggere near Haveri -515 acres; Doddakere near Hirekerur -765 acres; Doddakere near Devikop of Kalghatgi taluk- 434 acres; Honnavvanakere near Mugavad of Dharwad taluk- 603 acres; Anikere near Holekote of Hangal taluk-

537 acres, Hirekere near Naregal-602 acres; and Hirekere near Tiluvalli-862 acres. Apart from these, near Dambal of Gadag taluk and near Masur of Hirekerur taluk, there were two huge and famous ancient tanks. In 1884 there were 2,979 tanks which irrigated 93,730 acres area. The supplement to the Gazetteer of 1904 has mentioned that the district in 1903 had 2,784 irrigation tanks. Apart from these there were also 4,387 other tanks. According to another source in 1901; 2,404 tanks provided irrigation facilities to about 81,843 acres of land. In addition to these there were equal number of tanks not used for irrigation purposes which provided drinking water to cattle and people. Most of the irrigation tanks of Dharwad district are to the west of Harihar-Belgaum road. It is said that these have been constructed during the time of Vijayanagar Kings. In 1936 Dharwad had 2,348 irrigation tanks and they irrigated 90,393 acres. In 1955-56 tank irrigated area rose to 1,08,204 acres. In 1988-89 the district had 1,128 (upto 40 hectares irrigated) tanks covering about 1,820 hectares irrigated area and 2,024 tanks with an irrigated area of about 63,229 hectares (each tank with more than 40 hectares irrigation). During 1992-93 there were 276 tanks with less than 40 hectares irrigated area each and 2,800 tanks with more than 40 hectares irrigated area per tank.

**Wells:** The district in 1903 had 4,671 irrigation wells and 10,306 other wells. This figure stood at 4,320 in the year 1951. According to 1972 census on wells, the district had 9,455 irrigation wells and 225 multipurpose wells. Of the total wells 2,749 were constructed with stones, while 6,843 wells were constructed using only mud. Among these wells with a depth between 11-20 ft. number about 2,164; between 21-30 ft. about 3,832; 31 to 40 feet wells-2,339 and wells with more than 40 ft. deep about 937. Using water from irrigation wells, Jowar, Groundnut, fruits and other vegetables were cultivated. According to 1974 census on wells, the number of irrigation wells in the district reached 10,538. In 1984-85 there were 16,653 wells. This constitutes about 3% of the total number of wells in the State (for details see chapter 4). During 1992-93 the district had 13,764 borewells, 13,071 other types of wells, 7,399 domestic wells and unused wells accounted to about 2,802 according to Annual Season and Crop Report.

#### FAUNA

The district has a very rich *fauna* especially in its western portion. As animals are dependent on plants, diversified animals are found where the plant wealth is also diversified. On consideration of food availability, Ever Green forests are suitable for arboreal animals like monkeys. Deciduous forests support large herbivorous animals like bison, elephant, deer etc. Small herbivorous bucks, which can withstand famine, are found in scrub jungle.

**Mammals:** In the primate group, which includes man also (*Homo sapiens*) four types of animals, are found in the district. (a) Bonnet monkey – *Macaca radiata*, (b) Lion tailed monkey – *Macaca silenus*, (c) Hanuman Langur- *Presbytis entellus*, (d) Loris – *Loris tordigradus*

There are many carnivorous animals in the district. Tiger belonging to felidae family (*Panthera tigris*); leopard (*Panthera pardus*); wildcat (*Felis benghalensis*); Jungle cat (*Felis caeus*) and game leopard (*Acinonyx jubatus*) are important. Among these earlier reports indicate a large number of game leopards, but probably they are extinct now. Civet Cat belonging to Viveridae family (*Vivericula indica*) and grey cat (*Paradoxurus hermaphroditus*) is found in forests and outside the villages. Two types of mangoose are found in the district belonging to Harvestidae family. They are ordinary mangoose (*Herpestes edwardsi*) and red mangoose (*Herpestis vitticollis*).

The animals belonging to Canidae are *Canis lupus* (wolf), fox (*Canis aureus*), small fox (*Vulpes benghalensis*) and wild dog (*Cuon alpinus*). Hyaena or stripe hyena represent Hynidae family. Bears (*Melursis arsinus*) are found in the hilly regions. Tree rats (*Anathana ellioti*), brown rat (*Paraechinus micropus*) belonging to insectivorous groups and small field rats (*Suncus murinus*) are found in the district. Different types of bats (*Pteropus edwardsi*), wide ear bat (*Rinolopus*), fruit eating bats etc. are found in the district.

Members of rodents eat and destroy crops, grains, fruits etc.. These are squirrel (*Funambulus palmarum*), stripe squirrel (*Funambulus raptori*), wild squirrel (*Funambulus pneumorian*), grey squirrel (*Siurus indicus*), field rat (*Nicosia benghalensis*), bandicoot (*Sesonia bandicoot*), house rat (*Mus decumanus*), big home rat (*Mus musculus*), black rat (*Mus rattus*), grey rat (*Mus platythrix*), tree rat (*Mus oleraceus*); porcupine (*Hystrix lucura*), ordinary rabbit (*Lepus ruficaudatus*) and black rabbit (*Lepus nigricollis*) are mainly found in the district.

Among the hooved group of animals elephant (*Elephas maximus*), cattle (*Bos indicus*), sheep (*Ovis*), goat, bison (*Bibos gaurus*), wild goat, brown fursheep (*Tetracerus quadricornis*) Sambar (*Cervus unicolor*), ornamental deer (*Axis axis*) barking deer (*Muntiacus muntjac*) wild boar (*Sus cristatus*), violent boar (*Tragulus meminna*) and carapace boar (*Manis crossicaudatus*) are mainly found in the district.

Black buck is almost on the verge of extinction. In order to protect them, a sanctuary of 119 sq km. area has been established in Ranibennur taluk.

**Reptiles:** The following is a list of reptiles – The biggest reptile found here is crocodile (*Crocodylus palustris*). Other reptiles are, House lizard (*Hemidactylus brooki*), Garden lizard (*Calotes versicolor*), Big lizard (*Palmovilus dorsalis*), Chamaleon (*Chamaleon zeylanicus*), Salamander (*Mabuya ligosoma*), Flying lizard (*Draco dossimeari*). The other animals of this group are land tortoise (*Testudo elegans*), water tortoise turtles (*Trionyx leithi*), small snake (*Typhlos braminus*), python (*Python malurus*), and other variety of snakes include (*Eryx conicus*), and (*Ptyas mucosus*), stripe snake (*Oligodon verustus*); *Acrochordus granulatus*, *Natrix stolata*, garden snake (*Lycodon aulicus*), green snake (*Macropisthodon plumbicolor*), *Boiga trigonata* and leaf snake (*Dryophis sasutus*). Among the poisonous snakes- crait, cobra (*Naja naja*), king cobra- (*Naja henna*), russels viper (*Vipera russeli*), stone snake (*Echis carinatus*), green viper (*Trimeresurus gramineus*) are important.

**Amphibians:** Among the representatives of this group the following are found in the district. *Bufo melanostictus*, *Bufo fergusonii*, *Rana tigerina*, *Rana cyanoplyctis*, *Rana temporalis*, *Rana limnocharis*, *Rana keralensis*, *Mycrohyla ornata*, *Mycrohyla rubra*, *Maxixalus saxicola*, *Maxixalus opistorodus*, *Polypedatus maculatus*, and *Uperidon systoma*.

**Pisces :** Different types of fishes are available In the district in its rivers, ponds, tanks etc. Among the fish found in rivers, *carpa*, *catla*, *Rohu*, *Labeo rohita*, *Labeo fimbriatus*, *Labeo calbus*, *Labeo kalbasu*, *Masheer*, *Mirror carpa*, *Puncteus karnaticus*, *Puncteus dubius* are important. In the streams of hills *Cirrhina reba*, *Cirrhina mrigala* are available. Catfish *Wallago attu*, *Mistus* etc. which are large in size are important. *Clarius*, *Heteropneustus fossilis* and other small fish are common in tanks and ponds. Small fish can breath directly from air with the help of accessory respiratory organs.

The following is the list of other types of fish found in the district.

**Cyprinidae:** *Barilius bendelis*; *Amblypharyngodon mola*; *Aspidoparia morar*; *Rasbora daniconius*; *Danio acqipinnatus*; *Esomus barbatus*; *Barbus chola*; *Barbus jerdoni*; *Barbus colus*; *Barbus melanostigma*; *Barbus amphibious*; *Barbus dorsalis*; *Barbus stigma*; *Barbus ticto*; *Barbus dobsoni*; *Garra mullaya*; *Cirrhina fulungee*; *Cirrina reba*; *Rohtee vigorsi*; *Rohtee cotio*; *Rohtee neilli*.

**Cabitidae:** *Lepidocephalichthys guntea*; *Lepidocephalichthys thermalus*, **Siluridae** : *Ompok bimaculatus*, **Bagaridae:** *Mystus cavasius*; *Mystus malabaricus*, **Ophicephalidae** *Ophicephalus striatus*; *Ophicephalus punctatus*, **Ambassidae** : *Ambassis ranga*.

**Invertebrates** : Invertebrate animals are found in large numbers in the district. Protozoans like *Amoeba*, *Euglena*, *Paramecium*, *uplatis* and others are found in tanks and other water reservoirs. *Plasmodium*, *Entamoeba coli*, *Balantidium*, *Nictoterus* and such other parasites are also found. Among the *annelids* – earthworms, leaches and many molluscs are also found. Molluscs are found in rivers and large tanks. Many kinds of snails such as *pila* are found in tanks and canals in the gardens.

Insects are innumerable and many of them are pests of agricultural crops. Mosquitoes, which spread malaria and filariasis are found in the district. Locusts, moths, butterflies, beetles, humble bees are plenty. Honey bee, silkworm are insects useful to man. Nocturnals like centipede (*scolovandra*), millipede are found in the field. Ticks and fleas are parasitic on dog and cattle. Many types of spiders are also found.

**Avifauna:** Birds population in the district is varied and dense. The reason for this is the dense vegetation in the forests, and a number of insects on which birds feed on. The *malnad* region is highly suitable for birds. Birds are helpful to man in many ways. For many birds, insects are the main food. Birds destroy the swarm of locusts. In addition to this, birds many a time eat the eggs of insects also. Owl, kestrel, hawk etc. feed on the crop destroying animals like rats, bandicoots etc and thus control them. For purification of environment (crow, vulture, kite etc.), pollination, seed dispersal and also as food for man, birds are highly useful.

The 1884 Gazetteer refers to the Great Indian Bustard found in the black soil tracts of the district, more so near Karjagi and Ranibennur. This flightless bird is almost extinct now. It's closest relative Lesser Florican (*kannavilu*) can be more commonly found.

All the birds in the district have the ability of flight. There are local birds but many migrate to other neighbouring districts. Apart from this, there are many birds which migrate from outside the Country. The peacock, Pea fowl *Pavo cristatus*, the national bird of India represents the Galipese family. This is usually found in forests near water sources. Even though peacock cannot fly it can do so from tree to tree. The ancestor of domesticated fowls – Red spursh fowl – *Galoperdix spadicia* and grey jungle fowl-*Galus sonneratii* are found in the district. These usually live in shrubs in forests. Herons visit crop fields during winter. Black breasted herons are usually found in well grown grass lands and near cultivated areas. Purple moore hen (*Parphyrea parphyrea*), white breasted water hen (*Amorornis monicurus*) live in the sedges on the banks of tanks and canals.

Pigeons and doves have thin and not so powerful beaks. Grains and fruits constitute their staple food. These belong to genus *columbiformis*. Rock pigeon (*Columbia leavea*) lives usually in large dwelling houses and trees. Many people even domesticate this bird. Heavy bodied and with a powerful beaked green pigeon lives on forest trees. The legs of these birds are not suitable to walk on ground.



Little brown doves, *Streptopelia senegalensis*, which have a white spotted body usually live in open areas. These are usually found in cultivated areas either singly or in groups. The other birds of this group are – Ring dove (*Streptopelia dacocao*), spotted dove (*Streptopelia kinesis*) and red turtle dove (*Streptopelia traunkeberica*). The district has two types of crows – house crow (*Carvus splendens*) and jungle crow (*Carvus macrorincus*). Jungle crows though found in forests, often can be seen in villages near forests. The neck of the house crow is grey, while that of the jungle crow is black in colour. The koels (cuckoo) of India which have attracted the attention of countless poets since time immemorial (*Eudynamis scolapacia*) live in forests and gardens. These usually lay their eggs in the nests of crows and get them incubated by crows. The mother crow not being aware of the difference feeds them even after hatching. But once they grow and difference is known, they are forced out. Green parrot (*Cittacula cramerii*) belonging to *Cittasiformis* genus is found in all groves and forests. Another species *Cittacula cinocephala* is found rarely.

Owls are nocturnal birds. They belong to the group *Stringiformis*. They feed on small squirrels, rats etc. during night. These live in abandoned houses, graveyards and other dilapidated structures. *Atheri brama* (spotted owl) and *Strics asyatum* are the two types of owls found. Carnivorous birds like falcon, vultures, kites, hawks etc. belong to the group of *falconiformis*. The beaks of these are small but very sharp and strong. The talons are also very strong. These usually feed on the flesh of dead animals. These usually live on large trees on hilltops. The birds of this group are pariah kite (*Milvus migrans*), Brahmini kite (*Heliaster indus*) white vulture, scavenger vulture, eagle and white beaked vulture. Ducks belonging to *Anseriformis* group are found usually in irrigated areas. As the beaks are wide, these can catch fish easily. Certain types of ducks are also domesticated. Certain other types of ducks not only swim, but can also dive into water and catch fish and also fly from one place to another.

Nakta or weaverduck, *Sarkidiornis malanotus*, is usually found in water reservoirs. Tall duck (*Natapus coromandelianus*) is usually found all over. Besides other types of water birds like cranes live in the nearby water reservoirs. The capacity of flight of these birds is enormous. Legs, beaks, neck etc. are all very long. These are migratory birds. Grey heron (*Ardeya cineria*) is found all over the district and its main prey is fish. Cranes live by themselves singly near tanks ponds etc. Sometimes they stand still. Pond heron (*Ardeyola greyi*) lives in rice fields. Openbilled stark – *Anastomus* can be identified (living in marshy areas) with the help of its wide beak. The other birds which are important in this group are cattle egret (*Bubulus ibis*) and the curious night heron (*Nicticorax nicticorax*)

The list of birds found in this district is as follows;

Little grebe – *Podiceps ruficollis*; Grey Pelican-*Pelecanus philippensis*; Little Cormorant – *Phalacrocorax niger*; Darter – *Anhinga rufa*; Giant Heron – *Ardea goliath*; Purple Heron – *Ardea purpurea*; Large Egret – *Egretta alba*; Median Egret – *Egretta intermedia*; Little Egret – *Egretta garzetta*; Chestnut Bittern – *Ixobrychus striatus*; Painted stork – *Mycteria leucocephala*; White necked stork – *Coconia episcopus*; White ibis – *Threskiornis aethiopica*; White stork – *Ciconia ciconia*; Black ibis – *Pseudibis papillosa*; Glossy ibis – *Plegadis falcinellus*; Flamingo – *Phoenicopterus roseus*; Spoon bill – *Platalea leucorodia*; Bareheaded goose – *Anser indicus*; Lesser Whistling teal – *Dendrocygna javanica*; Brahminy Duck – *Tadorna ferruginea*; Northern pintail – *Anas acuta*; Common Teal – *Anas crecca*; Little Bittern – *Butorides striatus*; Yellow Bittern – *Iobrychus sinensis*; Spoon Billed Duck – *Anas poecilorhyncha*; Gadwall – *Anas strapera*; Wigeon – *Anas penelope*; Garganey – *Anas querquedula*; Northern shoveler – *Anas clypeata*; Demoiselle Crane – *Grus virgo*; Coot – *Fulica atra*; Great Indian

Bustard – *Choriotis nigriceps* rare; Pheasant Tailed Jacana – *Hydrophasianus chirugus*; Bronze Winged Jacana – *Metopidius indicus* Red Wattled Lapwing - *Venellus indicus*; Yellow Wattled Lapwing – *Venellus malabaricus*; Little ringed Plover – *Pluvialis fulva*; Common Sandpiper – *Tringa hypoleucos*; Little Stint – *Calidris minutus*; Wood Sandpiper – *Tringa glareola*; Bar tailed Godwit – *Limosa lapponica*; Black Tailed Godwit – *Limosa limosa*; Red Shank – *Tringa tetanus*; Green shank – *Tringa nebularia*; Eurasian Curlew – *Numenius arquata*; Painted snipe – *Rostratula benghalensis*; Black winged stilt – *Himantopus himantopus*; Common snipe – *Gallinago gallinago*; Stone curlew – *Burhinus oedicnemus*; Indian Courser – *Cursorius coromandelicus*; Little pratincole – *Glareola lacteal*; Sand Grouse – *Pterocles exustus*; River tern – *Sterna aurantia*; Grey partridge – *Francolinus pondicerianus*; Rain Quail – *Coturnix coromandelica*; Grey Quail – *Coturnix coturnix*; Coucal – *Centropus sinensis*; Brainfever Bird – *Cuculus varius*; Blossom headed parakeet – *Psittacula cyanocephala*; Black headed cuckoo shrike – *Coracina melanoptera*; Malkoha (small green billed)- *Rhopodytes viridirostris*; Rufous backed shrike – *Lanius schach* ; Bay backed shrike – *Lanius exubitor*; Black Drongo- *Dicrurus adsimilis*; White bellied Drongo – *Dicrurus caerulescens*; Small blue kingfisher – *Alcedo atthis*; White breasted kingfisher – *Hylcyon smyrnensis*; Pied kingfisher – *Ceryle rudis*; Stark billed kingfisher – *Pelargopsis capensis*; Small Minivet – *Pericrocotus cinnamomeus*; Scarl Minivet – *Pericrocotus flammeus*; Green Bee eater – *Merops orientalis* Indian Roller – *Coracias benghalensis*; Hoopoe – *Upupa epops* ; Grey Hornbill – *Tokus birostris*; Coppersmith – *Megalaima haemacephala*; Green backed wood pecker – *Dinopium benghalensis*; Mahratta wood pecker – *Picooides maharattensis*; Pigmy woodpecker – *Picooides nanus*; Crested lark - *Galerida cristata*; Skylark – *Alauda gulgula*; Indian pipit – *Anthus novaeseelandiae*; Tickells Flycatcher – *Cyornis tickelliae*; Magpie Robin – *Copsychus saularis*; Stone Chat – *Saxicola torquata*; Pied Bushchat – *Saxicola caprata*; Indian Robin – *Saxicoloides fulicata*; Black Redstart – *Phoenicurus ochruros*; Brown Rockchat- *Cercomela fusca*; Grey Tit – *Parus major*; Thickbilled Flower pecker – *Dicaeum agile*; White eye – *Zosterops palpebrosa*; Purple sunbird – *Nectarinia asiatica*; Purple rumped sunbird – *Nectarinnia zeylonica*; House sparrow – *Passer domesticus*; Baya weaver – *Ploceus phillippinus*; Black thriated weaver – *Ploceus benghalensis*; White throated Munia – *Lonchura malabarica*; Spotted Munia – *Lonchura punctulata*; White wagtail – *Motocilla alba*; Yellow wagtail – *Motacilla flava*; Large pied wagtail *Motacilla moderaspatisensis*; Jestrel – *Falco tinnunculus*; Laggar Falcon – *Falco jugger*; Black winged kite – *Elanus caerulens*; Jerelons leaf bird – *Chloropsis cochichinensis*; Great Pied Hornbill – *Buceros bicornis*; Indian Nightjar – *Caprimulgus asiaticus*; Marsh Harrier – *Circus aeruginosus*; King vulture – *Sarcogyps calvus*; Black Bellied Finch Lark – *Eremopterix guisea*; Rufoustailed Finch Lark – *Ammomanes phoenicorus*; Short Toed Lark – *Caledrella cinerea*; Dusky Crag Martin – *Hirundo concolor*; Wiretailed; swallow – *Hirundo smithi*; Redrumped swallow – *Hirundo daurica*; House swift – *Apus affinis*; Palm swift – *Cypsiurus parvus*; Golden oriole – *Oriolus oriolus*; Rosy pastor – *Sturnus roseus*; Brahminy Myna – *Sturnus pagadarum*; Common Myna – *Acridotheres tristis*; Jungle Myna – *Acridotheres fuscus*; Bank Myna – *Acridotheres gingianus*; Southern Jungle Myna – *Acridotheres fuscus*; Red vented Bulbul – *Pycnonnatus cafer*; Red whishered Bulbul – *Pycnonotus jacosus*; White browed Bulbul – *Pycnonotus luteolus*; Jungle Babbler – *Turdoides striatus* ; Common Babbler – *Turdoides caudatus*; Large grey Babbler – *Turdoides malcolmi*; Ashy wren warber – *Prinia socialisp*; Tailor Bird – *Orthotomos sutorius*; Red Breasted fly catcher – *Muscicapa parva*; Paradise flycatcher – *Terpsiphone paradisi*; Blacknaped blue flycatcher – *Monarcha azurea*; Streaked fantailed warber – *Cisticola juncidis*; Brown Chiff Chaff – *Phylloscopus collybita*; White spotted flycatcher – *Rhipidura albicollis*; Greyheaded flycatcher – *Culicicapa ceylonensis*.

Migration of Birds: The oriental bird club of Britain commissioned a survey headed by Dr.J.C.Uttangi in order to find out whether tanks and other places in the district are suitable for local and migratory birds. This survey was undertaken to find out the living habits of water birds and measures to be taken to increase their population. This survey revealed that the different *tanks* of the district supported ten types of water birds., Thousands of demosyls (heron group), water birds, big ducks, pointed tailed ducks. Gargeni types of herons visit the district as migratory birds during rainy season when water becomes clear and supports many types of aquatic organisms, groups of water birds migrate to the district from distant places. Tall trees and the presence of marshy sedges is helpful for water birds to build nests and rear young ones. Local water birds also build nests. However, the migratory birds, more than rearing young ones grow very well and return to their native place. Among the migratory birds – ducks which have long legs, long neck with powerful beaks, herons, sea crows, white birds of Europe and water fowls are important. White and brown diver birds stay for sometime in fresh water ponds. Dr. Uttangi who has studied 54 tanks of the district has recommended the establishment of some facilities in 23 tanks to help water birds.

The tanks of *malnad* areas of the district such as Hangal, Hirekerur, parts of Haveri, Dharwad and Shiggaon have attracted a number of water birds. This survey has indicated that Magadi tank of Shirhatti is suitable for long beaked ducks. For migratory birds, the Madagamasur tank of Hirekerur is a conducive place. Niralagi tank and Naregal tanks of Hangal taluk are highly suitable for white spotted birds. Heggere of Haveri, Akki Alur, Belavatti, Havanagi, Makaravalli, Hirekerur tanks of Hangal, Magadi, Bellati and Menache of Shirhatti taluk, Neerasagara, Keregeri, Narendra tanks of Dharwad Honnapur tank, Tabakada Honnahalli Devikop and Hirehonnahalli of Kalghatgi, Chikhandigol of Gadag, Dambal of Mundargi Chikbasur, Kaginelli of Byadgi, Asundi and Gudagoor of Ranibennur, and in Mydoor tanks local and migratory birds usually stay. Water birds fly elsewhere in search of water after the tanks dry up. When tanks dry up farmers dig the silt and carry it to their fields. Water birds, which are found in roadside tanks, get disturbed due to traffic. Sedges and other plants if removed from tank bunds will destroy nests of water birds. Therefore the survey recommends that irrigation tanks should be regarded as shelters of water birds. The reasons for bird migration are still not known. According to the latest information available now climatic conditions and day length seem to be mainly responsible for migration and paucity of food may also be one of the reasons.

#### FLORA

The main forest types in Dharwad district are – moist deciduous forests, scrub and thorn forests. Moist deciduous forests are limited to the *malnad* regions. They cover the western fringe of the district where the rainfall is relatively heavy. These forests exhibit regional variation from dense forests to the poorer types. Teak is the main tree in these forests. Trees here grow to a height of between 9 to 12 metres. Trees are very dense surrounding Kalghatgi, Shiggaon and Tadasa. While moving to the east, trees become sparse and their height also gets reduced. Bamboo groves are found all along the banks of rivers. In moist deciduous forests, grasses are plenty and provide fodder for cattle.

In border areas – Mango, Jackfruit., Tamarind, Peepul, Banyan trees grow very well. The thorn forest is typical of the dry black soil plains and the tree growth is relatively abundant along the banks of the rivers and streams. The scrub forests are met with in the northern and eastern most parts and offer a dry landscape dotted with sporadic growth of thorny shrubs and rough grasses. In these jungles acacia trees are prominent. In places like *Kappatagudda*, *Gajendragadgudda* etc. scrub jungles are seen.

Because of dry weather and poor soil quality trees and herbs grow sparsely. Along the roadsides neem trees are common. In sandy soil Toddy Palm and in gardens Banana, Guava, Sapota, Mango, Jackfruit, Custard apple, Lime, Coconut, Arecanut trees, grow usually.

The following is a detailed list of plants with their botanical names and the families to which they belong:

**Ranunculaceae:** *Naravelia zeylanica*;

**Brassicaceae:** *Rorippa indica*;

**Cleomaceae:** *Cleome aspera*; *Cleome felina*

**Capparaceae:** *Cadaba fruticosa*; *Capparis cleghornii*; *Capparis divaricata*; *Capparis sepiaria*; *Capparis zeylanica*; *Capparis grandis*; *Maerua oblongifolia*;

**Pittosporaceae:** *Pittosporum dasycaulon*;

**Polygalaceae:** *Polygala arvensis*; *Polygala erioptera*;

**Caryophyllaceae:** *Arenaria neelgherrensis*; *Polycarpaea corymbosa*

**Portulacaceae:** *Portulaca oleracea*; *Portulaca quadrifida*;

**Hypericaceae:** *Hypericum japonicum*;

**Malvaceae:** *Abelmoschus ficulneus*;

**Violaceae:** *Hybanthus enneaspermus*; *Abutilon crispum*; *Abutilon pannosum*; *Hibiscus lobatus*; *Hibiscus trionum*; *Sida rhombifolia*; *Sida spinosa*; *Thespesia populnea*;

**Bombacaceae:** *Adansonia digitata*;

**Sterculiaceae:** *Eriolaena quinquelocularis*; *Gauzuma ulmifolia*;

**Tiliaceae:** *Corchorus fascicularis*; *Grewia abutilifolia*; *Grewia hirsuta*; *Triumfetta rhomboidea*; *Triumfetta pilosa*; *Triumfetta rotundifolia*

**Rutaceae:** *Aegle marmelos*; *Limonia acedissima*; *Murraya paniculata*;

**Balanitaceae:** *Balanites aegyptiaca*

**Meliaceae:** *Chloroxylon swietenia*; *Melia azedarach*;

**Olacaceae:** *Ximenia Americana*;

**Celastraceae:** *Cassine glauca*; *Celastrus paniculatus*;

**Hippocrateaceae:** *Reissantia grahamii*;

**Rhamnaceae:** *Ventilago denticulate*; *Ziziphus xylopyrus*; *Ziziphus oenophlia*; *Ziziphus maruritiana*;

**Vitaceae:** *Ampelocissus tomentosa*; *Cayratia auriculata*; *Cayratia trifolia*; *Cissus setosa*;

**Sapindaceae:** *Dodonaea viscosa*; *Schleichera oleosa*;

**Ancardiaceae:** *Anacardium occidentale*; *Rhus mysorensis*;

**Fabaceae:** *Alysicarpus bupleurifolius*; *Alysicarpus monilifer*; *Alysicarpus procumbens*; *Alysicarpus rugosus*; *Atylosia scarabaeoides*; *Clitoria ternatea*; *Crotalaria orixensis*; *Crotalaria prostrata*; *Crotalaria pusilla*; *Dalbergia lanceolaria*; *Dalbergia melanoxydon*; *Dalbergia paniculata*; *Goniogyna hirta*; *Indigofera astragalina*; *Indigofera cassioides*; *Indigofera cordifolia*; *Indigofera oblongifolia*; *Indigofera spicata*; *Neonotonia wightii*; *Pongamia pinnata*; *Pterocarpus marsupium*; *Rhynchosia minima*; *Rhynchosia rufescens*; *Rothia indica*; *Shuteria vestita*; *Smithia sensitive*; *Stylosanthes fruticosa*; *Tephrosia purpurea*; *Tephrosia strigosa*; *Vigna radiata*;

**Caesalpiniaceae:** *Caesalpinia coriaria*; *Cassia auriculata*; *Cassia mimosoides*; *Cassia surattensis*; *Cassia tora*; *Hardwickia binnata*;

**Mimosaceae:** *Acacia chundra*; *Albizia amara*; *Neptunia triquetra*;

**Crassulaceae:** *Kalanchoe laciniata*;

**Combretaceae:** *Terminalia crenulata*;

**Myrtaceae:** *Syzygium cumini*;

**Lythraceae:** *Lagerstroemia parviflora*; *Woodfordia fruticosa*;

**Cucurbitaceae:** *Luffa acutangula*; *Luffa tuberosa*;

**Molluginaceae:** *Glinus lotoides*; *Mollugo pentaphylla*; *Trianthema crystalina*;

**Aizoaceae:** *Zaleya decandra*; *Zaleya pentandra*

**Apiaceae:** *Bupleurum mucronatum*; *Pimpinella heyneana*

**Alangiaceae:** *Alangium salvifolium*;

**Rubiaceae:** *Canthium parviflorum*; *Gardenia gummifera*; *Gardenia turgida*; *Ixora arborea*; *Neanotis montholonii*; *Oldenlandia aspera*; *Oldenlandia auricularia*; *Oldenlandia caerulea*; *Oldenlandia nitida*; *Oldenlandia umbellata*; *Pavetta tomentosa*;

**Asteraceae:** *Bidens biternata*; *Blepharispernum subsessile*; *Blumea lacera*; *Blumea membranacea*; *Blumea obliqua*; *Caesulia axillaris*; *Carthamus tinctorius*; *Centratherum anthelminticum*; *Cyathocline purpurea*; *Dicoma tomentosa*; *Echinops echinatus*; *Flaveria trinervia*; *Glosscardia bosvallea*; *Glossogyne bidens*; *Grangea maderaspatana*; *Hymenanthemum tenuifolium*; *Lagascea mollis*; *Pluchea tomentosa*; *Senecio tenuifolius*; *Siegesbeckia orientalis*; *Sphaeranthus indicus*; *Tricholepis radicans*; *Tridax procumbens*; *Vicoa indica*;

**Plumbaginaceae:** *Plumbago zeylanica*;

**Ebenaceae:** *Diospyros montana*;

**Oleaceae:** *Chionanthus malabarica*;

**Salvadoraceae:** *Azima tetraantha*; *Salvadora persica*;

**Apocynaceae:** *Carissa hirsuta*; *Carissa spinarum*; *Catheranthus pusillus*; *Holarrhena antidysenterica*; *Ichnocarpus frutescens*; *Vallisneria spiralis*;

**Asclepiadaceae:** *Caralluma truncato-coronata*; *Ceropegia candelabrum*; *Ceropegia juncea*; *Cynanchum tunicatum*; *Gymnema perularioides*; *Gymnema sylvestre*; *Leptodenia reticulata*; *Pentstemon capensis*; *Pergularia daemia*; *Sarcostemma acidum*; *Sarcostemma intermedium*; *Sarcostemma stocksii*; *Telosma pallida*;

**Periplocaceae:** *Hemidesmus indicus*;

**Gentianaceae:** *Canscora decurrens*; *Canscora diffusa*; *Centaurium centaurioides*; *Enicostema hyssopifolium*;

**Heliotropiaceae:** *Heliotropium indicum*; *Heliotropium rariflorum* ; *Heliotropium supinum*;

**Ehretiaceae:** *Carmona retusa*;

**Cordiaceae:** *Cardia gharaf*; *Cardia macleodii*;

**Convolvulaceae:** *Argyreia cuneata*; *Argyreia imbricata*; *Convolvulus arvensis*; *Convolvulus rotterianus*; *Evolvulus alsinoides*; *Ipomoea cairica*; *Ipomoea eriocarpa*; *Ipomoea illustris*; *Ipomoea obscura*; *Ipomoea staphylina*; *Ipomoea turpethum*; *Ipomoea turbinata*; *Merremia aegyptica*;

**Cuscutaceae:** *Cuscuta reflexa* ;

**Solanaceae:** *Nicotiana tabacum*; *Solanum erianthum*; *Solanum nigrum*; *Solanum pubescens*;

**Bignoniaceae:** *Dolichandrone atrovirens*; *Millingtonia hortensis*; *Radermachera xylocarpa*; *Stereospermum suaveolens*;

**Acanthaceae:** *Adhatoda zeylanica*; *Andrographis paniculata*; *Andrographis gangetica*; *Andrographis mysorensis*; *Barleria cristata* ; *Barleria cuspidata*; *Barleria mysorensis*; *Blepharis maderaspatensis*; *Blepharis repens*; *Crossandra infundibuliformis*; *Dipteracanthus patulus*; *Dipteracanthus prostratus*; *Dyschoriste erecta*; *Dyschoriste vagans*; *Eranthemum capense*; *Eranthemum roseum* ; *Gantelbua urens*; *Hemigraphis dura*; *Hemigraphis latebrosa*; *Hygrophila polysperma*; *Indonesiella echioides*; *Justicia glabra*; *Justicia quinqueangularis*; *Lepidagathis cristata*; *Meynia hawtayneana* ; *Nelsonia campestris*; *Phaulopsis dorsiflora*; *Rhinacanthus nasutus*; *Rostellularia procumbens*;

**Verbenaceae:** *Clerodendrum phlomidis*; *Clerodendrum serratum*; *Lantana indica*; *Priva cordifolia*; *Stachytarpheta jamaicensis*; *Symphorema polyandrum*;

**Lamiaceae:** *Anisomeles indica* ; *Lavandula bipinnata*; *Leucas lavandulifolia*; *Leucas martinicensis*; *Leucas stricta*; *Leucas urticifolia*; *Plectranthus mollis*;

**Nyctaginaceae:** *Commicarpus chinensis* ;

**Amaranthaceae:** *Achyranthes aspera*; *Aerva javanica*; *Aerva sanguinolenta*; *Alternanthera sessilis*; *Digera muricata*;

**Chenopodiaceae:** *Chenopodium album*; *Chenopodium murale*;

**Polygonaceae:** *Polygonum chinense*; *Rumex dentatus*;

**Aristolochiaceae:** *Aristolochia bracteolata*;

**Piperaceae:** *Piper galeatum*; *Piper longum*; *Piper nigrum*;

**Lauraceae:** *Cinnamomum verum*; *Cryptocarya bourdillonii*; *Litsea chinensis*;

**Loranthaceae:** *Viscum articulatum*;

**Santalaceae:** *Santalum album* ;

**Euphorbiaceae :** *Acalypha fallax*; *Acalypha indica*; *Bridelia stipularis*; *Chrozophora prostrata*; *Chrozophora rottleri*; *Cleidion spiciflorum*; *Drypetes venusta*; *Euphorbia antiquorum*; *Euphorbia coccinea*; *Euphorbia corrigioloides*; *Euphorbia cristata*; *Euphorbia geniculata*; *Euphorbia heterophylla*; *Euphorbia heyneana*; *Euphorbia hirta*; *Euphorbia indica* ; *Euphorbia laeta* ; *Euphorbia perbracteata*; *Euphorbia prostrata*; *Euphorbia tirucalli*; *Givotia rottleriformis*; *Kirganelia reticulata* ; *Phyllanthus maderaspatensis*; *Phyllanthus virgatus*; *Securinega leucopyrus*; *Tragia hispida*;

**Ulmaceae:** *Holoptelea integrifolia*;

**Moraceae:** *Artocarpus gomezianus*; *Ficus drupacea*; *Ficus virens* ; *Morus macroura*; *Plecosperrum spinosum*; *Streblus asper*;

**Casuarinaceae:** *Casuarina equisetifolia*;

**Orchidaceae:** *Eria mysorensis*; *Eulophia ramentacea*; *Habenaria grandifloriformis*; *Habenaria heyneana*; *Habenaria longicorniculata*; *Habenaria marginata*; *Habenaria roxburghi*; *Peristylus lawii*; *Rhyncostylis retusa*; *Zeuxina strateumatica*;

**Zinziberaceae:** *Curcuma neilgherrensis*;

**Hypoxidaceae:** *Curculigo orchioides*;

**Dioscoreaceae:** *Dioscorea sativa*;

**Asparagaceae:** *Asparagus asiaticus*; *Asparagua racemosus*;

**Liliaceae:** *Chlorophytum lexum*;

**Commelinaceae:** *Commelina subulata*; *Cyanotis tuberosa*;

**Arecaceae:** *Phoenix humilis*;

**Alismataceae:** *Limnophyton obtusifolium*;

**Aponogetonaceae:** *Aponogeton natans*;

**Eriocaulaceae:** *Eriocaulon robusto-brownianum*;

**Cyperaceae:** *Cyperus articulatus* ; *Cyperus exaltatus*; *Cyperus iria*; *Cyperus rotundus*; *Fimbristylis bisumbellata*; *Fimbristylis complanata*; *Fimbristylis ferruginea*; *Fimbristylis tetragona*; *Fimbristylis wallichiana*; *Kyllinga nemoralis*; *Mariscus bulbosus*; *Mariscus squarrosus*; *Rhynchospora rugosa*; *Schoenoplectus articulatus*; *Schoenoplectus litoralis*;

**Poaceae:** *Alloteropsis cimicina* ; *Aristida adscensionis*; *Aristida hystrix*; *Aristida redacta*; *Aristida setacea*; *Anthraxon hispidus*; *Anthraxon lanceolatus*; *Anthraxon lancifolius*; *Anthraxon tuberculatus*; *Brachiaria dustachya*; *Brachiaria eruciformis*; *Brachiaria ramose*; *Chionachne koenigii*; *Chloris barbata*; *Chloris dolichostachya*; *Chloris virgata*; *Coelachurum lagopoides*; *Coix lacrymajobi*; *Coix martini*; *Cynodon dactylon*; *Cynodon patens*; *Dendrocalamus strictus*; *Dichanthium caricosum*; *Dichanthium filiculme*; *Dichanthium huegelii*; *Dichanthium pertusum*; *Digitaria abludens*; *Digitaria longiflora*; *Digitaria stricta* ; *Digitaria ternata*; *Digitaria retroflexa*; *Echinachloa stagnina*; *Elytrophorus spicatus*; *Eragrostiella bifaria*; *Eragrostiella brachyphylla*; *Eragrostis asper* ; *Eragrostis cilianensis*; *Eragrostis minor*; *Eragrostis nutans*; *Eragrostis pilosa*; *Eragrostis tenuifolia*; *Eragrostis viscosa*; *Eremopogon feveolatus*; *Eriochloa procera*; *Eriochloa trispicata*; *Garnotia fergusonii*; *Hackelochloa granularis*; *Hymenachne pseudointerrupta*; *Isachne elegans* ; *Isachne globosa*; *Isachne pilosum*; *Iseilema laxum*; *Iseilema prostratum*; *Lophopogon tridentatus*; *Malancechris jacquemontii*; *Microchloa indica*; *Oplismenus busmanuii*; *Oplismenus compositus*; *Urochloa panicoides*; *Vetiveria lawsonii*; *Oropetium roxburghianum*; *Oropetium thomaeum* ; *Panicum antidotale*; *Panicum sumatrense*; *Paspalidium geminatum*; *Paspalum hohenackeri*; *Phragmitis karka*; *Pseudanthistiria heteroclita*; *Pseudanthistiria hispida*; *Pseudoraphis spinescens*; *Rottboellia cochinchinensis*; *Saccharum officinarum*; *Saccharum spontaneum*; *Saccolipsis interrupta*; *Sehima nervosum*; *Sehima sulcatum*; *Setaria italica*; *Setaria pumila*; *Setaria verticillata*; *Spodiopogon rhizophorus*; *Sporobolus capillaris*; *Sporobolus coromandelianus*; *Sporobolus indicus*; *Sporobolus piliferus*; *Sporobolus tremulus*; *Thelepogon elegans*; *Themeda triandra*; *Trachys muricata*; *Tragus roxburghii*; *Tripogon bromoides*; *Tripogon jacquemontii*;

**Scrophulariaceae:** *Limnophila indicap*; *Sopubia viscosa*; *Striga angustifolia*; *Striga densiflora*;

#### ECOLOGY AND ENVIRONMENT

Industrial activity is an inseparable part of development. Industries are not only involved in production but have also provided jobs for a large number of labourers. However, this has a number of implications on biological resources and an impact on the environment. Industries and related activities add pollutants to the environment including air, water and soil. Depending on the type of raw material used, effluents are released into the environment either as wastes or as byproducts. Addition of these pollutants to the environment has a harmful influence on agriculture and related activities posing a number of social problems.

Pollutants are those wastes, or unwanted materials added on to the environment disturbing the natural balance of components in water, air, or soil. Noise pollution creates intolerable levels of sound disturbing normal life of man. Addition of sewage to flowing water or tanks or ponds results in water pollution. Due to this there is depletion of oxygen content in water. Addition of materials not normally found in water also brings about water pollution. Industries are mainly responsible for water pollution. Among the industrial effluents that cause pollution, Oxygen depleting substances, harmful and poisonous chemicals are very important. Untreated effluents from factories will not be useful either for drinking or for use in agriculture.



Harihar poly fibres and graciline plants that are situated at Kumarpatna in Ranibennur taluk of Dharwad district, have caused great harm to more than 100 villages along the banks of Tungabhadra. Started in 1972 the Harihar poly fibre produces everyday 162 tonnes of rayon grade wood pulp. As a result of this, daily 33,000-cubic feet of solid industrial waste is produced. Gwalior rayon silk manufacturing company (GRASIM) started production in 1977 and it produces rayon fibres from wood pulp. This industry produces 800 tonnes of gracilin thread per month and uses 575 cubic metre of water per hour. 400 cubic metre of waste products is produced per hour. As a result of these waste products, harmful effects have been felt on cattle, people and also on land. NGO's like Transnational centre (TNC), India development centre (IDC) are trying to bring awareness among the affected people in making them learn about environmental education. Presently the villagers themselves have started environmental committees and have started the following programmes

(a) When environmental problems are faced, find out reasons, make everyone aware of it and look for solutions., (b) Starting non-violent direct action by giving suitable training., (c) To help scientists obtain proper data and information (d) Coordinating with villages having similar problems and arranging suitable workshops.

During Feb. 1984, near Harihar, in the down stream of Tungabhadra, fish died in large numbers and according to people there, similar things happen at least two or three times a year, ever since the industry started in Kumarapatna. Owing to the pressure of environmentalists, the Pollution Control Board, banned release of effluents into the river by the Harihar poly fibres factory. When the percentage of dissolved oxygen reached the normal stage the ban was withdrawn. The factory also agreed to transfer the coal ash dumped at Nelavaagalhalli.

In Aremallapur of Ranibennur taluk, India Development Society (IDS) has helped in starting community cultivation scheme. This NGO has taken the responsibility of total village development scheme among the 51 villages of drought prone area of the district. In this region, landless farmers often face shortage of fodder to look after their cattle. The government has sanctioned 10 acres of land to the IDS to grow fodder. Besides many Departments of Government are rendering cooperation. Planting of subabul to conserve soil, arranging stone masonry to check soil erosion and cultivating plants like *acacia*, *agave*, *subabul* fodder plants of various types along the slope are some of the experimental activities going on in these regions. Along with this, poor women of villages are given assistance to start dairy activities and help them to sell milk, curd etc. in the nearby towns.

Usually in the atmosphere, the ratio of oxygen, nitrogen and carbon dioxide is in a fixed proportion without any major change. Combustion activities in factories, vehicles and houses produce many types of gases and dust and this is released into the atmosphere. If these pollutants are present in the air we breathe, it impairs health. Sulphur dioxide, nitrogen, ashes, coal ash, carbon dioxide, dust particles etc. combine in the atmosphere with other particles. In addition to this, hydrocarbons and other complex chemicals, if present in higher quantity than allowed in the atmosphere, will have a harmful effect on the health of people. In places where concentration of factories and vehicles are more, the problem of air pollution is very serious. Air pollution will also influence climate and other parameters of atmosphere. Soil is one of the basic component of the environment. Soil pollution may be defined as inactivating and disturbing this component by certain compounds due to the activities of man. If waste products are in excess, the absorbing capacity of soil is lost. Poisonous chemicals remain in soil solution and harm plants and other biological activities. When absorption is totally affected, these

poisonous chemicals pollute even the underground water table. Aluminum, arsenic, boron, calcium carbonate and bicarbonate are soil pollutants soluble in water. Because of solid wastes even a fertile agricultural land becomes a waste and cannot be used for cultivation.

Generally speaking except for few roads with concentration of vehicles noise pollution has not posed a big problem. Since every one of man's activities produce solid, liquid or gaseous air pollutants, they have to be processed before they are released into the environment. Knowledge about pollution, its effects and the necessity to control it have been understood by people recently. With the incorporation of Water (Pollution and Control) Act of 1974 pollution control has come into force. Karnataka Pollution Control Board was established in 1974 as an autonomous organization. Ever since 1981, Air (Pollution control and prevention) Act has been promulgated, air pollution control rules and regulations have come into force. In the State, both air and water pollution control rules are in force and they have been put into effect. Even before the factories are getting established, they are given information about air and water pollution and their responsibility to control them. Due to this, factories can establish pollution control mechanisms soon after they start functioning. In rare instances, when these are not followed, factories are subjected to severe regulations and with the rapid expansion of agricultural activities on earth, new methods of land use are coming into picture. Man started cultivating plants of his choice after removing natural plant cover, and forest vegetation. As a result of this original plant cover and wild animals have disappeared in many instances. 15 types of trees including fruit trees and horticultural crops have become important components in arboriculture. In addition to this, food and fodder crops also grow temporarily on the land. In Dharwad district Arecanut (3.66%), Orange (10.25%), Coconut (8.76%), Guava (15.04%), Jackfruit (2.61%), Mango (37.74%), Pomegranate (0.82%), Chikkoo (15.28%), and Tamarind (5.81%), trees are important plants of arboriculture. Agriculture and related activities have largely harmed natural vegetation of the plains. In particular, scrub jungle of Deccan plateau has almost been totally destroyed. Except for some strategic places wild life is almost absent. In arboriculture tree canopy helps in withstanding and absorbing water, and also in retaining water in the soil not allowing it run off. Use of forest trees for firewood and fodder are putting tremendous pressure on forests these days. In such a situation, encouraging arboriculture will help meet the needs and will be able to sustain forests. Even though there are no specific estimates of pesticides used in the control of crop disease, pesticides used for controlling the diseases of Paddy and Cotton do not cause much harm. Man and his domesticated animals are part of the biological spectrum. Domesticated animals are used for ploughing, water lifting and manure production. As such these constitute an important link in the biological web.

The life on earth and the environment that sustain it are collectively termed as biosphere. The total environment including biosphere and the corresponding abiotic component constitutes the ecosystem. In the present set up, over-production of human beings has over-burdened the environment that supports them (human beings) and the balance of ecosystem is being disturbed. Industrialization and urbanization have resulted in housing problem, water problem, sewerage problem, smoke problem, etc. Total hygiene of society and its well being is threatened.

Environmental education, is the ability to identify problems confronting our surroundings and to find solutions for those problems. In our State awareness about environmental education, and environmental problems began only recently. As per the scheme of renewal of the primary education system aided by UNICEF, The Directorate of State Education Research and Training (DSERT) has published a booklet titled "Teachers' guidelines in Environmental Education. Environmental education

is given importance in education. Non-formal and continuing education centres of the State have simplified environmental issues in textbooks and are helping people to learn about environment. The department of State education research and training has published books '*we and our environment and light of life*'.

The DSERT has also published a booklet "Let us learn about environment" under the Adult Education programme. Teachers who are involved in adult education programme are being given 21 days training. In extra curricular activities such as science exhibitions, importance is given to environmental education material. Environmental awareness is created through games and nature training camps. World wild life fund, Karnataka branch has been organizing several nature-training camps. Several nature clubs also have been started. Environmental conservation camps are also being organized through The National Service Schemes. (NSS).

#### FOREST

According to the reports of forest department out of 13,782 sq km. of Geographical area in the district, 1,436.73 sq km. land area is in the control of forest department. Out of this 1,271.54 sq km. is reserve Forest, 14.01 sq km. - protected forest, 93.21 sq km. - Classified forest and 57.97 sq km. - private forest. According to the 1991-92 annual season and crops report talukwise forest area (in hectares) and percentage forest area are as follows : Kalghatgi 19,526 (16.95), Mundargi 17,646 (15.32), Dharwad 13,554 (11.77), Shirhatti 12,943 (11.24), Ranibennur 10,614 (9.22), Shiggaon 9,951 (8.64), Hirekerur 8,876 (7.71), Hangal 8,474 (7.36), Byadgi 4,889 (4.24), Haveri 3,849 (3.34), Hubli 2,033 (1.77), Gadag 1,749 (1.52), Savanur 801 (0.70), and Ron 276 (0.24). Forests of considerable extent are not found in the taluks of Nargund, Navalgund and Kundgol,. The percentage distribution of forest out of the geographical area of each taluk is - Kalghatgi 28.4, Mundargi 19.96, Shiggaon 16.89, Shirhatti 13.64, Dharwad 12.12, Ranibennur 11.73, Byadgi 11.20, Hirekerur 11.0, Hangal 10.93, Haveri 4.81, Hubli 2.76, Gadag 1.59, Savanur 1.49 and Ron 0.21, Byadgi 4,889 (4.24), Haveri 3,849 (3.34). Forests are distributed more towards the western part of the district. In the State, the forest area is 20% of the geographical area and the all India figure is about 23%. National forest policy specifies that this should be about 33%. However, the percentage distribution of forests in the district (8.47%) is far below the specified percentage.

The average forest area in the district is about 0.04 hectares. And therefore it is difficult to meet the needs of people or Industries. The forest area of the district is spread in Dharwad and Gadag divisions, which belong to the Belgaum forest range. Moist deciduous forests are found in the district. These types of forests have plenty of timber yielding trees. It is conducive for the growth of timber yielding trees like Rose wood, Teak, *Honne*, and *Nandi*. These forests are important from the point of view of timber, firewood and also from other factors. Scrub and thorn forests are also more in the district. Sandalwood and other trees yielding minor forest products, firewood and other timber yielding trees are found. The requirements here put tremendous pressure on the limited forest resources available.

**Minor forest produce:** Keeping taluk as a unit, minor forest produce are leased out for a period two to three years. Among the most important minor forest produce so leased are the myrobalon (*Terminalia chebula*). Tamarind, phyllanthes, honey, wax, soapnut, saponin fruit, Dhoop, bark of cinnamon dye yielding fruits and a number of medicinal plants.

**Use of Forest Wealth:** Forest wealth should be systematically exploited keeping in view the need for continuity of the existing wealth and returns based on the availability. While so doing, meeting the needs of forest based industries, natural regeneration, maintaining the forest in the original condition and creation of forests should be encouraged. A variety of forest products are obtained from the forests and they are used for various industries and sold to people. Forests in the district are maintained based on specific projects and programmes. These are planned for a period of 10-15 years based on available trees, demand for forest products, maintenance of soil moisture and ecological balance. In areas where they are classified as low grade, afforestation of forests is taken-up on a large scale.

Felling of trees with green foliage has been banned and only dried and uprooted trees can be cut. The Karnataka State forest Industries Corporation which is a State enterprise is involved in such activities like the production of logs, major forest products, rosewood, teak, plywood and other timber yielding trees, and eucalyptus, match stick wood, firewood, sandalwood and bamboos. Timber coming from timber yards is classified based on quality, girth and length. The prices of these are fixed based on their quality and put to public auction. Such auctions take place three or four times in a year. Timber and other forest products are also released for retail sales periodically on a prefixed price. Forest products are also sold to defence and railway departments based on mutually agreed rates.

**Forest Development Schemes :** A number of forest development schemes are being implemented in the district. The main aim of forest development schemes is to increase the level of production of degraded forests by afforestation. This would improve the forest wealth and provide people with timber, fodder, and firewood. Fodder is cultivated in degraded forests and Government non-revenue land including C and D class lands. The district has 16098 ha; of Government degraded land and 37,957 ha of C and D class land and up to 31.3.1989; 37,847 ha. of C and D class lands have been transferred from revenue department to forest department. Programmes like social forestry and establishment of decentralized nurseries are helping in afforestation. The forest nurseries in Dharwad district are at Budawal (Hubli taluk), Divisional forest office compound (Dharwad taluk), Hangal, Kusnur, Honkana (Hangal taluk), Gangibhavi (Shiggaon taluk), Kalkundi (Kalghatgi taluk), Gangajalatanda, Bevinahatti, Vikalapur (Ranibennur taluk), Sidenur, Gundagatti, Harikatte (Hirekerur taluk), Sangur (Haveri taluk) Dambal, Jalavadagi, Harogeri, Doni, (Mundargi taluk), Bidanal, Chabbi (Hubli taluk) Tangoda, Jalligeri (Shirhatti taluk) Gajendragad (Ron taluk) Nabhapur (Gadag taluk) and Chikkanargund (Nargund taluk).

Increased afforestation is carried out under all the programmes. Degraded forest, roadside land, tank bed etc. which are revenue degraded lands are included under afforestation programmes. Decentralized nurseries are growing a large number of saplings under Jawahar Rojgar Yojana, social forestry and national degraded land development scheme. Under the centrally sponsored scheme, around 340 hectares of land have been brought under afforestation to conserve the soil by spending around Rs.60 lakh during the period 1987-92 in the catchment area of the Tungabhadra river. Under another centrally sponsored scheme, with 50:50 participation of State and Centre, plantations have been established in an area of 1,100 hectares during the same period. These plantations have been established mainly in degraded forest land and other Government degraded lands. Under the centrally sponsored scheme, around Rs.55 lakh have been utilized in the district, about 1.96 crore saplings have been raised during the period 1987-92. When forest land is released for non forest uses, as a compensation, plantations are established under forest rules 1980. When forestland is released

plantations are established in an equal area of non-forestland. If there is no non-forestland available, twice the amount of that area should be brought under plantation. When non-forestland is identified and plantation is established, it will be declared a protected forest area and will be freed from the interference of man and other animals.

**Black Buck Sanctuary, Ranibennur:** The blackbuck (*Krishnamriga*) sanctuary has been declared as a wild life park in 1974. The forest area of this sanctuary is spread between 14° 33' to 14°47' north latitude and east longitude of 75°32' to 75°51' including the taluks of Ranibennur, Byadgi and Haveri having a total of 119.89 sq km. area. This wild life sanctuary is at a distance of 16 km. from Ranibennur. The sanctuary has an undulating landscape and the highest point is at a height of 700 m mean sea level. Some rivulets flow here but dry up during summer. Most of the area consists of thorn and scrub forest and there is a lot of soil erosion. Hence afforestation is taken up in barren area from 1956. Importance is given to the cultivation of local eucalyptus trees. Wolves, wild boar and peacocks are also found in plenty.

**Children's Zoo:** There is a Children's Zoo near Binkadakatte of Gadag taluk. This is located two-km. away from Gadag town. A plan is afoot to make it into a full-fledged Zoological garden and work is in different stages of progress during 1991-92.

#### CLIMATE

As the district is near the equator, it has a tropical climate. The climate of the district is characterized by general dryness except during monsoon season. The district has an agreeable and healthy climate. The district is in the northern plains of the State, and the weather is hot during summer, and cold during winter while it has a high content of moisture during rainy season. Rainfall is irregular and indefinite. The year may be divided into four seasons; viz., Winter (December-February), Summer (March to May), Southwest monsoon season (June to September) and Northeast monsoon season (October to November). Summer sets in during the second half of February and lasts till the end of May. This season is marked by harsh eastern winds, rising temperatures, whirlwinds and occasional thunderstorms accompanied by sharp showers. Southwest monsoon season starts during early June and lasts till the end of September. This is a period of cool and damp climate. The months of October and November constitute the post monsoon or the northwest monsoon season and this period witnesses a gradual rise in day temperatures and a substantial amount of rainfall as well. The winter season covers the period from December to mid February. The district enjoys a moderate weather and does not suffer with extreme summer or winter.

**Rainfall:** According to the report of the Indian Meteorology Department, there are 14 rain gauge centres in the district and the rainfall data is available for about 50-80 years. Details of rain gauge centre wise and month-wise rainfall for the years between 1901 to 1950 is given in table 1.4. The average annual rainfall for the district (1901 to 1950) is 691.1 mm. The western parts of the district adjacent to *Sahyadri* receives maximum rainfall. As we move towards the east the quantum of rainfall decreases. While the annual rainfall in Kalghatgi near Western Ghats is 914 mm, in Mundargi it is 465 mm. The annual rainfall occurs between June to September. Maximum rainfall occurs in the month of July. Sometimes heavy rainfall accompanied thunder occurs during later half of summer and northeast monsoon months. Northeast monsoon winds contribute about 22% rainfall of the district. The annual rainfall variations are not significant. During the 50 year period, 1901 to 1950, the highest annual rainfall in the district was 144 percent of the normal recorded in the year 1933. The lowest annual

rainfall amounting to 66 per cent of the normal occurred in 1945. But in the eastern parts of the district where the rainfall is comparatively less than in the rest of the district, the variations from year to year is large. In the 50 year period the annual rainfall in the district was less than 80 per cent of the normal in only six years and none of them were consecutive. However, considering the annual rainfall at individual stations two consecutive years of such low rainfall occurred once nine out of 14 stations. Dharwad recorded seven consecutive years of an unusual spell of such low rainfall from 1936 to 1942. The annual rainfall in the district was between 500 to 800 mm in 39 years out of 50. On an average there are 54 rainy days (i.e days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 33 at Mundargi to 72 at Kalghatgi. The heaviest rainfall recorded in 24 hours at any of the stations in the district was 290.1 mm at Nargund on 1959 July 2<sup>nd</sup>. Mundargi taluk is one of the two driest taluks of the State (The other one being Challakere taluk of Chitradurga district). Average monthly rainfall between 1901-1970 and talukwise recorded annual rainfall between 1970-1992 (in mm) is in tables 1.5 and table 1.6.

**Temperature:** There is a meteorological observatory in the district at Gadag and the records of this observatory may be taken as representative data of the climatic conditions in the district in general. After February there is a steady increase in the temperatures. April is generally the hottest month with the mean daily maximum temperature at 37.3°C and the mean daily minimum at 22.5°C. Nights during May and June are as warm as in April. During summer the day temperature may occasionally rise upto 41°C on individual days. Afternoon thundershowers, which occur on some days during summer season, bring welcome relief from the heat though temporarily. With the onset of the southwest monsoon into the district during early June, there is appreciable drop in the day temperature but nights are still warm as in the later part of the hot season. From September day temperatures again increase slowly and a secondary maximum in day temperature is recorded in October. But the nights become progressively cooler from September onwards. December is generally the coldest month with the mean daily minimum temperature at 16.5°C. The mean daily maximum temperature during this month is 29.1°C. On individual days during the period December to February the minimum temperature may go down to about 11°C. The highest maximum temperature recorded at Gadag was 41.7°C on 1939 May 15th. The lowest minimum was 10°C recorded on 1975 December 26th. Monthwise temperature and relative humidity as recorded in Gadag is given in table 1.7.

**Humidity:** During the monsoon season the humidity is high generally being over 80 per cent. The humidity decreases in the post monsoon period. The driest part of the year is the period between January to March when the relative humidity in the afternoon is about 30 per cent. Details of relative humidity figures are available in table 1.7.

**Cloudiness:** During the southwest monsoon season the skies are mostly heavily clouded. Cloudiness decreases in the post-monsoon period. In the period from December to February the skies are generally clear or lightly clouded. Cloudiness increases from April onwards, the afternoons being generally more cloudy.

**Winds:** Winds are generally light with some increase in force during late summer and monsoon seasons. During November and December the winds both in the mornings and evenings blow predominantly from east to southeast. During January and February the winds blow predominantly from southeast to south in the mornings, but during February winds from north and northwest are also not so uncommon. In the evenings the winds are mostly from southeast or east. March and April are the months of transition. During these months the southeasterly winds are gradually (first in the

morning and later also in the evenings) replaced by northwest or westerly winds. From April to September the winds are predominantly from northwest or west directions. October is again the transitional month during which the reversal of direction of the winds is completed. The details of monthly average wind speed are given in table 1.8.

**Special Weather Phenomena:** During the post monsoon season, storms and depressions from the Bay of Bengal which weaken after crossing the east coast and occasionally move into the Arabian sea affect the weather over the district causing widespread and locally heavy rain and strong winds. Thunderstorms occur in the summer and post monsoon seasons. Fog occurs during the cold season. Tables 1.8 and 1.9 give mean wind speed and Special weather phenomena respectively for Gadag.

Table 1.4 : Details of Normal and Extreme Rainfall (mm)

Name of the Raingauge station	No. of years of data available	Annual												Highest annual rainfall as % of normal and year**	Lowest annual rainfall as % of normal and year**	Amount (mm)	Date	
		January	February	March	April	May	June	July	August	September	October	November	December					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Dharwad	50	a	1.5	8.9	48.3	74.4	95.3	174	121.4	102.4	125.2	48	11.9	813.3	165	63	147.3	6th August 1914
		b	0.1	0.1	0.7	3.3	5	8.3	15.9	11.8	7	7.8	2.9	63.6	1946	1905		
Hubli	50	a	1.5	9.4	36.6	70.1	81.8	113.3	87.6	100.8	111.5	42.9	11.9	668.6	162	62	133.6	14th September 1927
		b	0.1	0.2	0.7	3.1	4.9	7.6	12.4	8.7	7.3	2.8	0.7	55.5	1933	1918		
Kalghatgi	50	a	0.8	1.5	7.9	40.1	135.4	232.7	153.9	99.8	114.8	43.4	10.9	913.8	147	57	133.3	26th September 1924
		b	0.1	0.1	0.6	2.9	4.6	11.4	18.8	14.8	8.8	7.2	2.5	72.3	1933	1918		
Shiggaon (Bankapur)	50	a	2.3	1.5	5.1	32.3	62.5	155.7	101.3	78.5	111.3	37.6	10.2	689.2	149	53	118.6	19th November 1948
		b	0.2	0.1	0.4	2.5	4.1	9.2	15.6	11.5	7.2	6.6	2.4	60.5	1943	1905		
Hangal	50	a	2.5	1.3	6.6	38.1	64	138.9	268.7	148.3	72.9	112.5	39.4	904.4	149	48	161.5	30th June 1959
		b	0.2	0.1	0.5	2.7	4	11.2	19.1	13.7	7.6	6.7	2.5	68.9	1933	1911		
Hirekerur	50	a	2.5	4.3	3.8	34.8	71.6	101.9	111.5	85.6	119.6	49.8	13.2	798.2	152	55	144.8	8th July 1888
		b	0.2	0.3	0.3	2.7	4.2	9.5	17.9	11.9	7.5	7.1	3	65.3	1932	1918		
Ranibennur	50	a	2.8	2.5	6.9	32.8	70.4	68.8	96.8	76.5	109.5	46.5	15.5	619.4	142	52	169.4	22nd December 1906
		b	0.2	0.2	0.6	2.7	4.6	6.6	10.5	7.8	6.6	2.5	0.7	49.2	1932	1905		
Haveri	50	a	4.3	3.3	7.9	43.2	79.8	158.7	101.9	89.4	121.4	49.3	15	769.2	166	52	192.8	21st May 1943
		b	0.2	0.2	0.5	2.5	4.6	9	15.2	10.5	7.1	7	0.7	60.2	1933	1905		



**Table 1.4 : Details of Normal and Extreme Rainfall (mm) (Continued)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Gadag	50	a	2.8	2.5	7.1	30.7	69.1	71.1	67.6	92.2	129	112	44.2	9.4	637.7	163	54	171.5	7th October 1947
		b	0.5	0.3	0.6	2.7	4.5	5.3	6.5	7.3	7.3	6.8	2.9	0.6	45.3	1943	1934		
Mundargi	50	a	2	2.3	3.1	19.6	51.1	53.6	38.1	59.9	101.3	89.1	36.8	7.6	464.5	163	36	127.5	3rd October 1906
		b	1	0.2	0.3	1.7	3.8	3.8	4.4	4.1	7	5.2	2.2	0.4	33.2	1946	1934		
Navalgund	50	a	1.3	3.8	5.3	28.5	62.7	65	67.6	71.1	130.8	111.8	36.3	10.7	594.9	176	46	154.9	18th October 1892
		b	0.1	0.3	0.5	2.5	4.7	4.8	6.2	5.4	7.5	6.4	2.1	0.6	41.1	1916	1904		
Nargund	50	a	2.5	3.3	5.1	24.4	61.5	49.5	57.9	60.2	123.9	85.6	34.5	8.9	517.3	196	47	290.2	2nd July 1959
		b	0.3	0.2	0.4	2	4.3	4.3	5.7	4.9	6.6	5.5	2.1	0.6	36.9	1933	1945		
Ron	50	a	1.3	3.1	4.1	19.6	52.1	80.5	65	79.8	153.4	99.1	37.9	10.7	606.6	199	53	170.2	6th December 1902
		b	0.1	0.3	0.5	2	3.9	5.6	6.3	6.4	8	5.6	2	0.5	41.2	1916	1945		
Savanur	50	a	1.5	2.8	4.1	34.3	77	89.1	123.7	89.4	88.7	113.5	39.9	12.2	676.2	144	49	101.6	24th October 1912
		b	0.1	0.2	0.3	2.5	4.8	8	13.3	9.6	6.8	6.5	2.4	0.7	55.2	1932	1905		
Dharwad	50	a	2.1	2.5	6.1	33.1	67.1	86.9	130	96.8	103	109.8	41.9	11.4	691.1	144	66		
		b	0.2	0.2	0.5	2.6	4.4	7.5	12	9.2	7.3	6.6	2.5	0.6	53.6	1933	1945		

a) Normal rainfall (mm)

b) Average number of rainy days (days with rain of 2.5 mm or more)

\* Based on all available data upto 1970

\*\*Years given in brackets.

Source: India Meteorological Department, Pune, 1984.

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**Table 1.5 : Talukwise details of Average Annual Rainfall (mm) received from 1901 to 1970**

Sl.No.	Taluk	January	February	March	April	May	June	July	August	September	October	November	December	Annual
1.	Byadgi	0.50	0.00	3.70	40.90	77.80	89.40	146.60	94.20	90.80	125.90	34.90	7.90	712.60
2.	Dharwad	1.40	1.30	7.10	48.60	81.90	102.50	183.80	118.60	107.50	129.90	44.90	11.00	838.50
3.	Gadag	2.80	1.90	5.70	39.00	80.90	72.70	70.50	83.40	132.70	126.90	38.80	10.40	665.70
4.	Hangal	1.90	1.10	5.80	38.60	70.20	142.00	283.20	151.70	73.10	117.50	37.50	10.80	933.40
5.	Haveri	3.10	2.30	7.70	44.50	82.40	93.80	164.90	98.30	90.70	126.50	42.60	13.30	770.10
6.	Hirekerur	1.90	3.20	3.80	37.80	74.30	101.10	209.10	111.40	86.80	125.10	43.60	11.70	809.80
7.	Hubli	1.10	1.20	6.80	40.60	77.50	85.80	120.40	84.30	106.30	118.30	40.00	10.70	693.00
8.	Kalghatgi	0.60	1.10	7.50	44.40	83.50	133.50	245.60	153.70	99.50	119.60	41.20	9.50	939.70
9.	Kundgol	0.00	9.70	7.90	58.70	108.50	89.10	135.70	75.60	118.60	114.60	52.50	7.50	777.90
10.	Mundargi	1.80	1.80	2.30	26.80	58.90	53.00	41.30	54.90	104.80	100.01	34.20	9.10	489.00
11.	Nargund	1.90	3.10	3.60	27.60	65.10	58.30	69.90	55.40	124.40	93.50	33.40	8.80	545.00
12.	Navalgund	1.00	3.00	5.90	33.20	72.20	64.70	73.20	67.40	130.60	118.00	32.30	10.00	612.10
13.	Ranibennur	2.00	1.90	5.60	37.50	77.50	69.40	98.80	71.10	86.00	119.60	40.50	13.40	623.30
14.	Ron	1.00	2.70	4.10	23.30	53.20	82.60	66.60	79.90	154.00	104.40	31.70	9.60	613.10
15.	Savanur	1.10	2.10	2.90	39.90	89.40	84.50	129.50	87.80	88.90	120.60	36.90	9.00	692.60
16.	Shiggaon	1.70	1.10	3.60	38.80	70.40	90.80	168.90	106.20	81.10	119.10	36.30	9.90	727.90
17.	Shirhatti	0.50	2.70	4.80	57.10	99.10	81.30	93.90	75.40	125.20	156.80	45.20	6.90	748.90
<b>District Average</b>		<b>1.40</b>	<b>2.40</b>	<b>5.20</b>	<b>39.80</b>	<b>77.80</b>	<b>87.90</b>	<b>135.40</b>	<b>92.30</b>	<b>105.90</b>	<b>119.80</b>	<b>39.20</b>	<b>10.00</b>	<b>717.20</b>
<b>State Average</b>		<b>2.90</b>	<b>3.60</b>	<b>7.40</b>	<b>37.50</b>	<b>86.60</b>	<b>181.80</b>	<b>284.70</b>	<b>189.90</b>	<b>149.80</b>	<b>134.30</b>	<b>48.60</b>	<b>11.70</b>	<b>1,138.60</b>

**Table 1.6 : Talukwise details of Annual Rainfall (mm) received from 1971 to 1981**

Sl.No.	Taluk	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1.	Byadgi	783.10	444.00	641.80	658.60	860.30	575.00	625.70	938.10	735.10	727.10	447.00
2.	Dharwad	722.70	637.80	715.30	877.60	661.40	583.70	857.70	761.40	1,016.40	926.40	1,009.00
3.	Gadag	589.90	598.00	643.70	858.30	905.10	466.60	752.40	539.00	611.60	606.60	548.10
4.	Hangal	760.10	868.30	866.50	943.00	1,015.10	806.00	1,009.00	1,633.10	1400.20	1,646.80	835.20
5.	Haveri	984.20	778.20	603.80	590.30	811.50	531.90	823.50	1,063.10	833.10	866.70	651.30
6.	Hirekerur	768.10	738.90	671.50	768.10	1,159.30	549.90	624.50	1,157.60	1,373.40	1,630.30	623.50
7.	Hubli	641.10	629.10	773.30	887.70	770.30	518.60	782.20	1,114.30	917.70	648.60	543.40
8.	Kalghatgi	914.00	938.30	1,228.80	1,071.90	1,590.20	1,166.90	951.50	880.70	1,122.90	1,189.40	871.50
9.	Kundgol	700.60	778.60	739.60	866.80	587.40	568.60	655.20	876.10	933.80	701.80	402.20
10.	Mundargi	413.80	466.60	476.30	692.40	605.20	276.70	670.20	720.40	784.70	412.30	637.40
11.	Nargund	551.20	446.90	582.10	1,048.50	785.00	421.50	543.70	527.50	732.70	198.70	528.70
12.	Navalgund	520.10	502.10	555.20	1,089.80	715.60	383.40	548.40	559.60	889.30	554.10	694.60
13.	Ranibennur	725.00	607.30	424.10	438.60	736.00	338.30	503.50	738.00	607.70	699.00	537.50
14.	Ron	585.20	402.30	624.40	1,191.80	1,048.20	1,026.90	838.80	621.60	1,405.10	633.80	1,131.90
15.	Savanur	623.10	649.50	619.60	821.70	785.30	605.00	622.40	988.20	866.30	648.10	397.70
16.	Shiggaon	727.30	602.80	753.60	717.00	904.20	609.40	666.20	1,364.70	1,349.40	1,666.40	831.30
17.	Shirhatti	563.50	563.20	690.50	1,058.90	889.20	596.20	1,043.90	1,175.80	897.30	650.20	502.90
<b>Total</b>		<b>11,573.00</b>	<b>10,652.00</b>	<b>11,610.00</b>	<b>14,581.00</b>	<b>14,829.00</b>	<b>10,025.00</b>	<b>12,519.00</b>	<b>15,660.00</b>	<b>16,477.00</b>	<b>14,406.00</b>	<b>11,193.00</b>
<b>District Average</b>		<b>680.80</b>	<b>626.60</b>	<b>682.90</b>	<b>857.70</b>	<b>872.30</b>	<b>589.70</b>	<b>736.40</b>	<b>921.10</b>	<b>969.20</b>	<b>847.40</b>	<b>658.40</b>

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**Table 1.6 : Talukwise details of Annual Rainfall (mm) received from 1982 to 1992**

Sl.No.	Taluk	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1.	Byadgi	883.80	449.60	662.40	347.40	621.20	662.40	554.10	482.20	335.40	977.40	1,152.50
2.	Dharwad	684.00	694.50	725.30	680.40	661.30	563.90	788.60	617.00	751.60	1,239.20	966.80
3.	Gadag	743.60	690.90	488.90	340.70	621.90	756.30	641.30	588.50	378.20	708.00	674.90
4.	Hangal	1,172.30	1,069.40	1,063.90	920.30	1,432.80	1,290.50	1,122.50	680.00	573.60	1,168.80	1,282.60
5.	Haveri	1,104.20	588.00	714.00	430.20	803.60	731.30	803.40	562.80	430.30	919.50	1,223.80
6.	Hirekerur	754.70	637.00	712.10	560.30	814.00	716.60	734.80	680.00	573.60	1,168.80	1,149.60
7.	Hubli	808.90	923.60	713.00	711.40	627.40	724.80	735.00	491.20	511.00	1,564.30	931.50
8.	Kalghatgi	923.00	919.70	965.10	786.20	702.80	951.60	964.00	577.50	835.60	958.20	1,106.50
9.	Kundgol	440.30	397.20	390.70	329.60	973.50	1,057.10	697.00	441.40	497.30	958.40	601.00
10.	Mundargi	543.90	456.00	410.00	254.80	565.20	737.40	558.70	386.40	409.30	489.40	636.70
11.	Nargund	601.70	491.10	288.00	353.80	600.00	579.20	577.50	480.20	303.50	545.10	512.30
12.	Navalgund	723.00	548.40	476.90	359.60	679.80	560.50	774.40	450.10	385.20	737.30	620.40
13.	Ranibennur	812.50	449.70	488.30	353.20	486.30	621.90	613.10	508.10	336.40	715.70	908.50
14.	Ron	1,203.60	640.90	457.70	320.20	651.50	860.50	852.70	377.00	461.60	726.70	633.20
15.	Savanur	762.90	664.40	633.10	424.10	684.60	578.90	597.10	650.00	359.00	788.00	880.50
16.	Shiggaon	721.20	668.80	853.80	453.00	839.40	674.50	614.90	549.90	592.40	924.20	1,125.60
17.	Shi rhatti	609.90	527.30	469.80	373.40	472.60	742.60	972.60	462.40	452.70	669.90	857.30
Total		13,494.00	10,817.00	10,513.00	7,999.00	12,238.00	12,810.00	12,602.00	8,985.00	8,187.00	15,259.00	15,264.00
District Average		793.80	636.30	618.30	470.50	719.90	753.50	741.30	528.51	481.57	897.58	897.90

**Table 1.7 : Details of Normal Temperature and Relative Humidity (Gadag)**

Month	Mean daily Maximum Temperature	Mean daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity	
	°C	°C	°C	Date	°C	Date	0.830*% 17.30*%	
January	30.3	16.7	34.5	29th Jan.1960	11.1	7th Jan.1951	61	35
February	33.0	18.6	37.7	28th Feb.1961	11.1	11th Feb.1950	54	31
March	36.0	21.0	40.0	20th Mar.1953	14.5	5th Mar.1971	58	31
April	37.3	22.5	41.1	23rd Apr.1941	17.2	15th Apr.1935	71	41
May	36.5	22.6	41.7	15th May 1939	17.6	5th May 1976	78	49
June	31.1	21.9	40.6	4th Jun.1953	18.3	5th Jun.1975	88	68
July	28.5	21.2	34.9	18th Jul.1960	18.9	4th Jul.1934	84	73
August	28.9	20.9	35.4	19th Aug.1969	18.3	15th Aug.1965	84	70
September	29.7	20.5	37.8	20th Sep.1951	17.2	19th Sep.1952	83	66
October	30.8	20.2	35.6	3rd Oct.1965	15.0	31st Oct.1974	75	57
November	29.8	18.4	37.2	24th Nov.1947	12.2	25th Nov.1939	64	46
December	29.1	16.5	34.1	31st Dec.1959	10.0	26th Dec.1975	63	41
Annual	31.7	20.1					72	51

\* Hours Indian Standard Time

**Table 1.8 : Monthwise details of Mean Wind Speed in km./hr. (Gadag)**

Jan.	Feb.	Mar.	Apr.	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
7.5	7.1	8.1	10.1	13.8	18.2	19.6	17.5	13.6	7.8	7.0	7.6	11.4

**Table 1.9 : Details of Special Weather Phenomena**

Mean No. of days with	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	0.1	0.1	0.9	5	6	2	0.6	5	3	3	0.8	0.1	27
Hail	0	0	0	0.1	0.3	0	0	0	0	0	0	0	0.4
Dust-Storm	0	0.1	0	0.1	0	0	0	0	0	0	0	0	0.2
Squall	0	0	0	0	0.1	0.1	0	0	0	0	0	0	0.2
Fog	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0	0.3

\* Number of days two and above are given in whole numbers