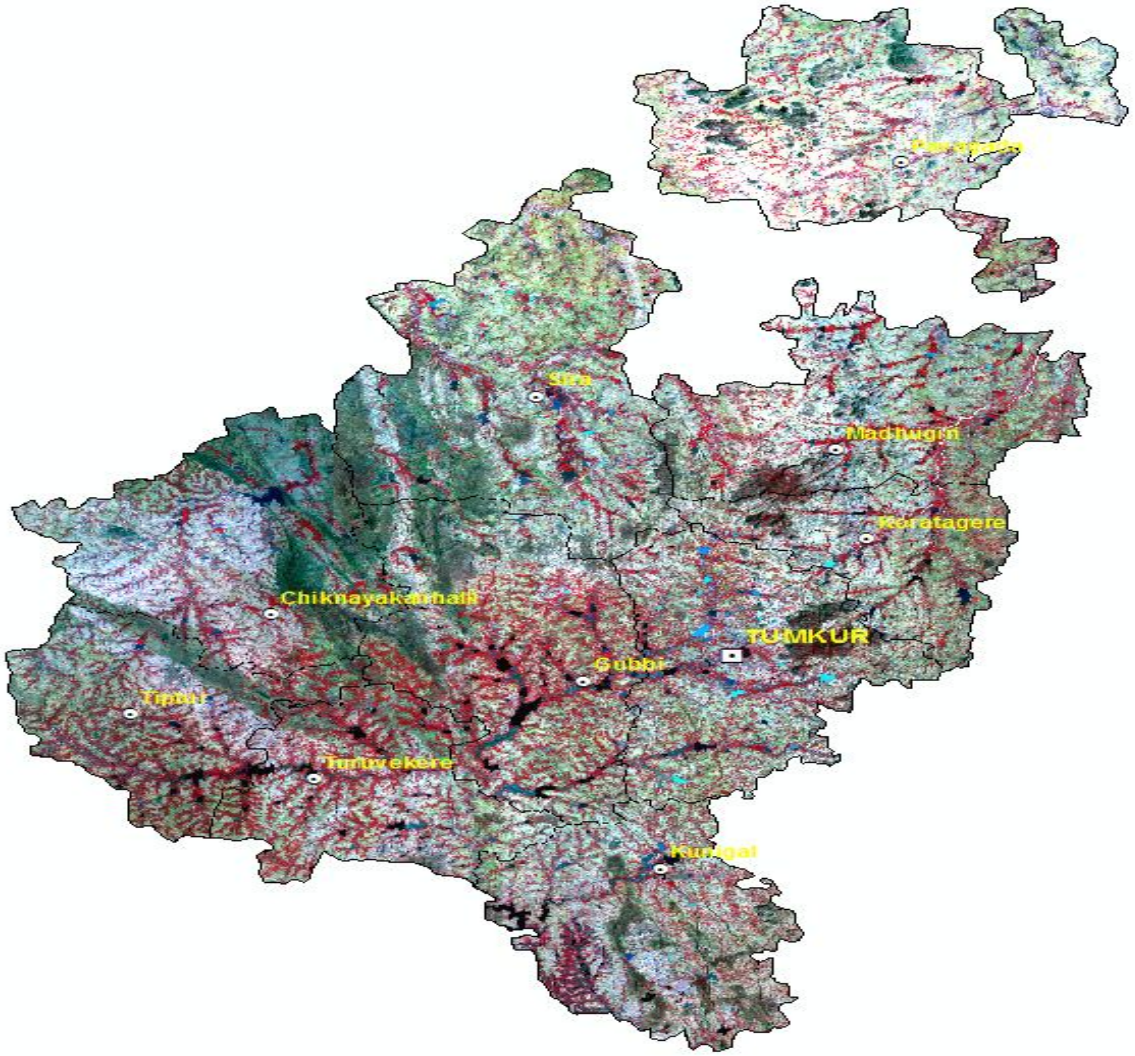
REPORT NO.553

SOILS OF TUMKUR DISTRICT

(KARNATAKA)

FOR

LAND USE PLANNING



REGIONAL CENTRE

BANGALORE

National Bureau of Soil Survey & Land Use Planning

(Indian Council of Agricultural Research)

Nagpur - 440 033, Maharashtra, India

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Meta Data for Soil Reports of Tumkur District, Karnataka

Sr.No.	Elements	Scheme	Value
1.	Identification Information	Name of the Dataset	Soils of Tumkur District (Karnataka)
		Contents	Soil Survey Reports, Maps and Imagery
		Keywords	Soil Survey Report
		Report/Map Language	English
		Map Scale	1:50000
		Survey Year	1976 - 1972
		Imprint Year	2001
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		Value-addition Year	2013
		Purpose of Value-addition	To Create Interactive Maps and Reports and Disseminate to the End-User Agencies.
		Access Constraints	Permission Required
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2.	Contact Information	Generating Agency	NBSS & LUP, Nagpur
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3.	Spatial Domain	Bound Left	76d21'08.7619"E
		Bound Right	77d29'56.3539"E
		Bound Top	14d20'52.2793"N
		Bound Bottom	12d44'24.1070"N
		Area/Coverage	10647 sq.km
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		Unit	Meter
		Administrative Location	State: Karnataka, District: Tumkur
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		Associated Project	C.S. Harindranath, R.S. Reddy
		Associated Value- additions	-
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		Data File Size	27 MB
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6.	Quick Look	Graphic file in jpg format	Y
7.	Image Data	Name of the Satellite	Landsat
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FOREWARD

"Earth needs to be nurtured with mother's care because Earth gives everything for sustaining life". I quote this in the context of soils that form one of the most precious natural resources of the earth. For sustainable agricultural production, it is necessary to focus attention on the soil, other land resources and conserving agro-technology generation for optimizing land use.

During the past few decades we have made significant strides in achieving self- sufficiency in food production. In order to meet livelihood and environmental requirements of the growing population, there have been compulsions of producing more and more from each unit area of land and this process is leading to depletion of natural resources.

In this scenario, knowledge of the soils, their extent, distribution, characteristics and use potentials gains prominence in optimizing land use on sustainable basis. The setting up of the National Land Resource Commission at the Centre and Land Use Boards in the States signifies the importance of soil resource maps at the national and state level for developing rational land-use plans.

The National Bureau of Soil Survey and Land Use Planning (NBSS & LUP) is engaged in preparing soil resource maps of different states on 1:250.000 scale and printing them on 1:500,000 scale; of the district on 1:50,000 scale, and of the watershed/farms on 1:10,000/1:5000 scale. Such soil maps of some states, districts have already been released and distributed to the user agencies to be adopted for their planning.

The present publication "Soils of Tumkur District of Karnataka for Optimizing Land Use Plan" has been brought out by the NBSS&LUP, Regional Centre Bangalore in co-operation with the Department of Agriculture, Govt. of Karnataka. The bulletin comprises the soil resource map describing their kinds, extent, distribution and potentials along with some important theme based maps. The bulletin provides a base for planning for developmental work in the fields of agriculture, horticulture, forestry and soil conservation to optimize land use on a sustainable basis.

I personally congratulate Dr. K.S. Gajbhiye, Acting Director and his team of devoted scientists of NBSS&LUP Regional Centre, Bangalore and the Department of Agriculture, Karnataka state who have worked untiringly to bring out this publication for the benefit of all those who have a stake on optimal utilization of land.

(J.S. Samra)

Deputy Director General (NRM)

Indian Council of Agricultural Research

New Delhi

PREFACE

The role of soil survey and mapping in optimising land utilisation of limited soil resources have been emphasised at different times and from different platforms. However, adequate attention is still not being paid resulting in sub-optimum utilisation and/or irreparable degradation of this basic resource.

The ever-increasing food requirement for the growing population in India demands optimum utilisation of soil resources. The soil resource mapping and classification provides basic database which can be used for planning and implementing land use strategies. This ever-increasing demand has been obliging to bring more and more area under cultivation which has earlier under forest cover. This has been adding to our soil degradation problems. Therefore, there is an urgent need to halt deforestation and to prevent degradation.

The National Bureau of Soil Survey and Land Use Planning has been preparing soil maps of different Districts in the country. The study will help not only to develop relationship between soils and physiography but also for better land use planning using the soil survey interpretation. The data can also be interpretated for allied uses of land.

The present attempt of bringing the bulletin on Soils of Tumkur district, Karnataka (1: 50,000 scale) may help the district level planner and policy maker to understand the soil resources, its problems and potential in the district. The maps in the report is prepared using the GIS in the original scale. The report has been very well written and shall help the land users to appreciate the intricacies of the formation, distribution, characterisation and classification of the soils of the district.

I congratulate Dr.P.Krishnan, Head, Regional Centre, Bangalore; Shri. C.S. Harindranath, Project Leader and other associated scientists/technical officials for bringing out this publication useful in the course of environmental studies in general and soil survey and mapping in particular.

Director

NBSS & LUP, Nagpur.

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ACKNOWLEDGEMENTS

The soil survey of Tumkur district is a collective effort of many persons in the Bureau. However the following deserve special mention for their help and guidance in releasing the project.

- Dr. P. Krishnan, Head, Regional Centre, Bangalore for moral support and facilities provided.

- Sri C.R. Shivaprasad, Principal Scientist and Dr L.G.K. Naidu, Principal Scientist, NBSS & LUP, Regional Centre, Bangalore, for his constant support to publish the report.

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- Sri Shivappa Angadi, Sri B.M.N. Reddy, Sri P. Ramesha, Sri M.V. Anantha, Technicians, NBSS & LUP, Regional Centre, Bangalore for their timely help in Cartography and other technical help.

- Smt. V.S. Sharada, Smt. P. Prabhavathamma, Personal Assistant, NBSS&LUP, Regional Centre, Bangalore and Smt. T.L. Pillai, Personal Secretary and Sri M.M. Khan, Personal Assistant, NBSS&LUP, Nagpur for typing of the draft report.

- Lastly those of the persons who have helped directly or indirectly for bringing out the report and maps, whose name(s) has been inadvertently left out.

HIGHLIGHTS

Reconnaissance soil survey of Tumkur District has provides the information on nature, extent and geographical distribution of different soils in the district. The data have been interpreted to generate various thematic maps such as land capability, land irrigability, problems, potentials, suggested land use and the suitability of soils for growing ragi, paddy, groundnut and coconut.

Tumkar District has an area of 1064755 ha of which about 72 per cent is suitable for agriculture and horticulture; about 20 per cent is suitable for forestry, pasture and silvipastoral systems, and about 8 per cent is for quarrying.

Red clayey soils occupy an area about 43 per cent; red gravelly loam soils about 20 per cent; red gravelly clay soils about 13 per cent, and loamy alluvial soils about 12 per cent.

The major problems are:

1. Shallow to moderate rooting depth,
2. High gravelliness, stoniness and rockiness,
3. Moderate slopes;
4. Sheet, rill and gully erosion,
5. Moderate to rapid runoff,
6. Medium to poor moisture retentivity,
7. Poor nutrient status,
8. Scanty vegetation and poor ground water potential.

Soils with such problems cover an area of 34.5 per cent and need appropriate soil and water conservation measures for sustained agricultural production.
Rocky, bouldery land with stony hard crust and skeletal soils, strong to moderate slopes, excessive relief and runoff cover 7.7 per cent and require permanent vegetative cover wherever possible, suitable for quarrying.

The potential for intensive agriculture accounts to 58.8 per cent. Maximum attention should be given to these soils for increasing agricultural and horticultural production in the district.

An area of 72.6 per cent of the district is suitable for growing Ragi of which 5.1 per cent is moderately suitable, 4 per cent marginally suitable and 63.5 per cent is moderately to marginally suitable.

Twenty one per cent of the area is suitable for growing paddy of which 7.3 per cent is moderately suitable, and 13.9 per cent is moderately to marginally suitable.

An area of 10.7 per cent is moderately suitable for cultivation of groundnut, 66.6 per cent is marginally to moderately suitable.

For coconut cultivation about 11.3 per cent is moderately suitable. 65.6 per cent is marginally suitable and 11.6 per cent marginally suitable to presently not suitable

The soils in the district are highly variable in nature and properties. For agricultural development of the district, it is essential that the nature of these soils be known to farmers, administrators and planners before deciding management of the land. The information can be used by different developmental agencies for increasing agricultural production in the district without causing further damage to the soil and land resources.

1.

INTRODUCTION

The soil is the major basic resource on which an existence of the man depends. Soils vary considerably in their characteristics and behaviour. The proper understanding of the soils is therefore, necessary for its best possible use to ensure sustainable agriculture. Soil maps prepared after conducting soil survey of an area provide the basic information on soil resources. The interpretation of soil data will help in predicting the suitability of soils for various uses. In view of this the reconnaissance soil survey of Tumkur district (Karnataka) was initiated in 1972. The work was completed in phase manner due to other priorities, and thus continued till last decade. Though late, it was decided to collate the information and document in a bulletin form so that the readers may have easy access to the resource data to be used for general and specified developmental planning of the district in the first decade of 21st century.

The objectives of resource inventory are:

- To identify and characterize the soils of the district and highlight their problems and potentials;
- To correlate and classify the soils according to soil taxonomy;
- To prepare a soil resource map of the district, delineating soil series associations, and
- To prepare interpretative maps based on soil-site characteristics for development of optimum land use plans.

2.

GEOGRAPHICAL SETTING

2.1 Location and Extent

Tumkur district is situated in the eastern part of Karnataka State between 12°30' north latitude and 76°15' east longitude. It extends 153 km North-South and 110 km East-West. It has an area of 1064755 hectares. It is bounded by Anantapur district of Andhra Pradesh on the north-east, Kolar and Bangalore districts on the east, Mandya district on the south. Chitradurga district on the north, and Chickmagalur and Hassan districts on the west. Administratively the district divided into ten taluks namely Tumkur, Gubbi, Kunigal, Turuvekere, Chikkanayakanahalli, Tiptur, Sira, Madhugiri, Pavagada and Koratagere. The district is covered by Survey of India toposheets No. 57 G/1 to 7, 57 C/6 to 16, 57 B/16, 57 D/13, 57H/1 and 2, respectively (Fig. 1).

2.2 Physiography, Relief and Drainage

Tumkur district forms a part of Karnataka plateau and may be divided into following physiographic zones.

1. Ridges of schist belt
2. Gently undulating plateau of granite-gneiss
3. Rugged lands on granites
4. Low lying pediments, floodplains of streams and rivers, and narrow valley.

The elevation ranges from 975 to 1097 metres above mean sea level in the Chikkanayakanahalli schist belt area; from 945 to 1261 metres in the Devarayanadurga range, and from 760 to 914 meters in the flat to undulating plateau. Apart from these there are hill peaks, and low ranges of granite hills spread over the district. The area is drained by the rivers Kumudvati and Jayamangli which are tributaries of Pennar river, and Suvamamukhi, a tributary of Vedavathi river. The southern portion is drained by the Shimsha river, a tributary of the river Cauvery.
The drainage pattern of the eastern part of the district is dendritic with a network of a number of small streams while the western portion has sub-parallel to dendritic pattern with a few streams.

2.3 Climate

The climate of the district is semiarid tropical. The area receives an average annual rainfall of 687.9 mm in 45 rainy days. The rainfall decreases gradually from the eastern parts of the district to the northern and western portions. The district can be divided into three rainfall zones, namely, (i) 550-650 mm (ii) 651 to 750 mm and (iii) more than 750 mm. Pavagada, Tiptur, Sira and Koratagere taluks receive the lowest rainfall, Tumkur taluk receives the highest rainfall, and the rest of the district area receives between 651 and 750 mm. (Table 1). Nearly 45-50 per cent rainfall is received during June to September, 25 - 30 per cent during October and November and 1.5 - 3.0 per cent during December to February. The remaining 15 to 25 per cent rainfall received in April and May is useful for preparatory tillage of the land.

The number of rainy days ranges from 35 to 54. Rains are uncertain and erratic, and cyclic semi-dry conditions are very common. Winters are generally mild while summers are quite warm with temperatures rising upto 38°C during April and May. The coolest month of the year is December.

The dry period in the district is from December to mid-April (Fig. 2). The moisture control section in the soil profile is considered to be dry in some or all parts for more than 90 cumulative days and as such the soils of the district are considered to have an ustic moisture regime. The difference between mean annual summer temperature and mean annual winter temperature is less than 6°C; hence the soil temperature class for the

LOCATION MAP

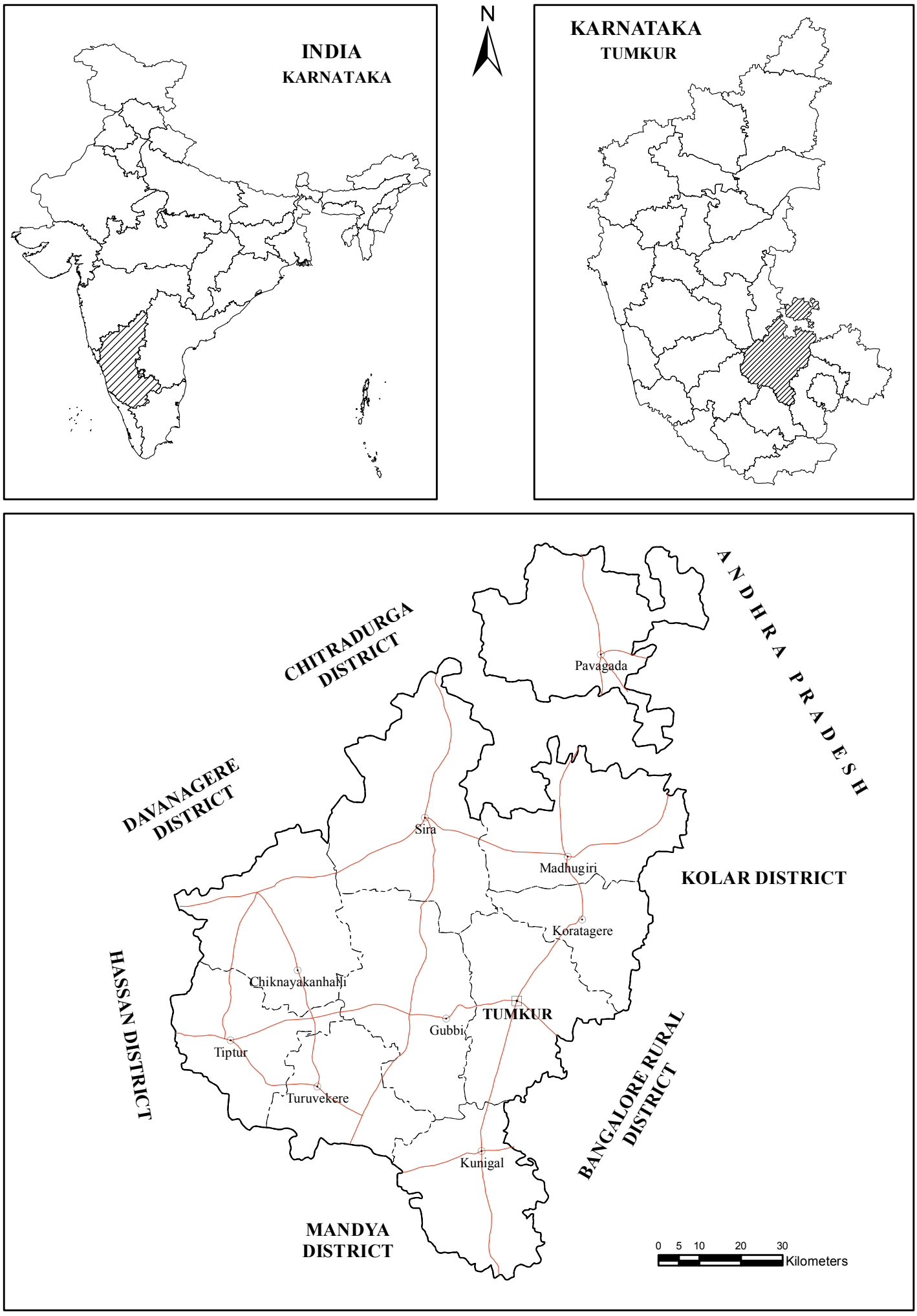


Fig. 1: Location Map

district is isohyperthermic. Since no data is available on soil temperature, atmospheric temperature data has been taken for arriving at a conclusion regarding the temperature regime.

Table 1. Climatological data of Tumkur District, Karnataka

Station: Tumkur, Latitude: 13°20' N, Longitude: 27°05'E, Elevation: 810.7 metres above MSL

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Mean annual monthly rainfall mm (1931-1970)	2.8	6.1	7.4	36.1	96.0	85.9	107.2	135.1	174.0	151.6	57.6	7.6	867.7
Mean number of rainy days	0.3	0.6	0.4	2.6	5.8	5.9	8.2	9.2	8.7	7.8	3.9	0.7	54.1
Mean monthly maximum temperature °C (1973-79)	28.9	31.1	33.8	35.3	33.5	29.8	27.0	28.8	28.5	28.4	27.5	27.3	29.5
Mean monthly minimum temperature °C	16.0	18.1	17.3	23.2	21.9	20.6	20.2	20.9	19.6	19.6	18.6	16.8	19.4
Mean monthly temperature °C	22.5	24.6	25.6	29.3	27.7	25.2	23.6	24.9	24.1	24.0	23.1	22.1	24.5
Mean monthly relative humidity %(1973-1975)	53.7	52.6	46.5	53.0	65.1	71.4	76.8	72.9	76.2	73.0	59.4	55.9	63.0

Source: Meteorology in the Service of Agriculture-Agroclimatology of Tumkur district Research Report No.2 University of Agricultural Science, 1979.
India Meteorological Department, Bangalore
Bureau of Economics and statistics, Karnataka

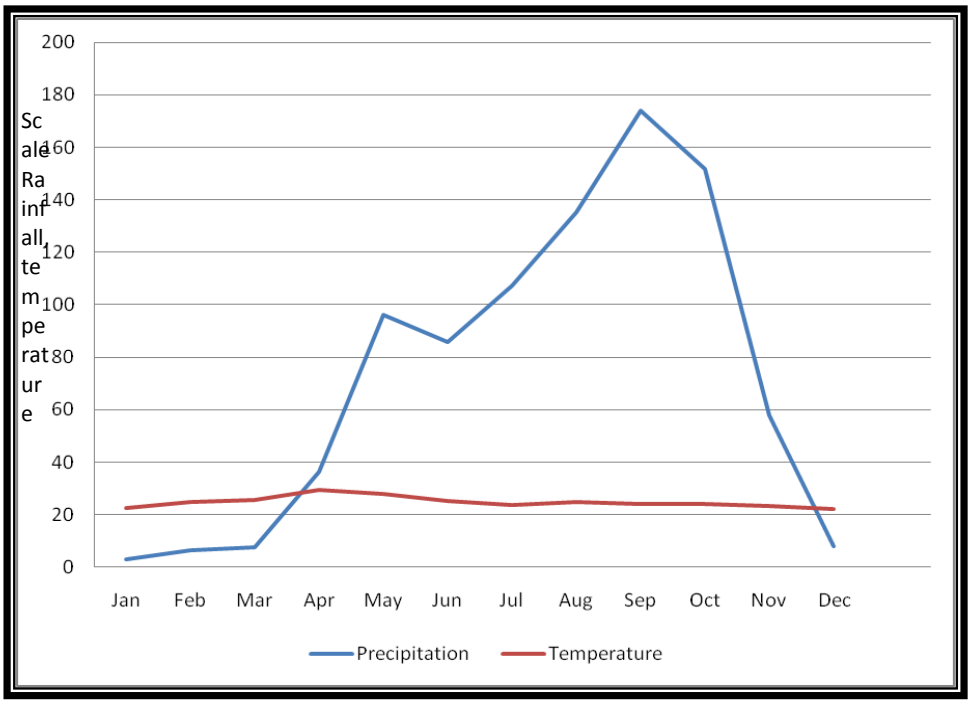


Fig: 2 Precipitation, Temperature and Water Balance-Tumkur District

2.4 Geology

Tumkur district is situated on the Archaean complex and the geology of the area is fairly simple. The rock formations belonging to the Archaean complex are represented by the crystalline schists, the granitic gneisses

and the newer granites. The crystalline schists of this district form the southern extension of the well-defined Chitradurga schist belt of the Dharwar system which is the oldest members of the Archaean complex. Apart from the main central schist belt to the east of Chikkanayakanahalli, there are many patches of highly metamorphosed schists scattered in the gneissic complex, the largest of these lying to the west of Huliyurdurga. The other two schist patches are less than a square mile, one of them is developed near the village of Tippasandra in Kunigal taluk and the other is developed near the village of Bidaloti in Koratagere taluk.

The schist belt which passes to the east of Chikkanayakanahalli spreads out to the west - north west near Banasandra, a branch which extends over 30-40 km. This belt is composed of chloritic schists, micaceous schists, quartzites, limestone and ferrugenous quartzites just near Bellara and Bukkapatna.

There are some basic and intermediate types of volcanic rocks, as flows and minor intrusions. Lately a pillow structure has been recognized in some of the flows in the vicinity of the abandoned gold mine near Bellara. Portions of the schist belt near Doddaguni exhibit clear evidences of sedimentation.

The highly calciferous limestone shows distinct signs of stratification and bedding. Chemical and mineralogical examination has confirmed the original sedimentary nature of the rock formations.

These schists are intensely altered and new minerals like diopside, hypersthene varieties of garnets, cordierite, sillimanite and corundum have developed giving rise to several interesting rock types. All these rock types are considered to be highly metamorphosed phases of impure argillitic sediments preserved here and there as remnants of the original schists in the gneissic complex.

The narrow schist belt of Chikkanayakanahalli as well as the scattered schist patches occurring to the west of Huliyprdurga, Kunigal and Koratagere is all surrounded by the gneissic complex. The major portion of the district is covered by this complex of granite gneisses which are classed under a separate group named Peninsular gneisses. This gneissic complex is said to be composed of four major components as follows: 1. Banded gneisses 2. Granitic gneisses, 3. Gneissic granites and granites and 4 Granodiorites, Diorites, interaction diorites and other varieties.

2.5 Natural vegetation

The total area under the forest in Tumkur district is 850 sq.km which is hardly 4 percent of the total geographical area. The forest region in the district is found to a large extent in the lower slopes of hill ranges, viz. Devarayanadurga hills, hills around hill Koratagere, ranges near Madhugiri, chain of hills near Kibbanahalli, the areas around Bukkapatna, Huliyurdurga, Kundurakkanava and Keepalpura. The forests are open and consist of mixed species varying from dry deciduous to thorny bushes. The growth never attains the height of 9 metres. The forests consist mainly of fuel trees.

These forests are classified under the Southern tropical thorny forest series.

Following are some of the most common species found in the area

Shorea talura (Jalari), *Anogeissus latifolia* (Dindigal), *Pterocarpus marsupium* (Honne), *Terminalia tomentosa* (Karimatti), *Terminalia chebusa* (Alale),Terminalia arjuna (Tormatti), *Tamarindus indica* (Hunise), *Tectona grandis* (Tega), *Santalum album* (Gandha), *Albizzia labbeck* (Bage) *Boswellia serrata* (Dhupa), *Hardwickia binata* (Mummara). *Acacia catechu* (Kaggali), *Wrightia tinctoria* (pale), *Canthium pervijlorum* (Kare), *Dodonia viscoss* (Bandre), *Cassia agriculate* (Thangdi) *Cassia fistula* (Kakke), *Albizzia amera* (Chujjalu).

Underground vegetation and grasses are very scanty. Regeneration in dry tract is very poor. The forest species have been replaced at many places by eucalyptus. Casuarina species are grown in farm forestry in uplands and gravelly soils. *Tamarindus indica, Pongamia glabra, Azadiracta indica, Acacia arabica* and *Ficus* species are some of the plants commonly seen around the farm area in small clusters or as road avenue trees which have dual purpose use in the rural areas. Attempts to establish eucalyptus and other species avenue trees along the roads are being made.

3.

AGRICULTURE AND LAND USE

3.1 Land Utilization

Total geographical area of Tumkur district is 10,64,755 hectares. The net sown area is 634146 hectares. The net sown area is maximum in Pavagada and Sira taluks followed by Tumkur, Kunigal, Chikkanayakanahalli and Gubbi taluks (54,000 to 58,000 ha). Least sown area is in Koratagere taluk (Table 2). Sira taluk has maximum geographical area of 1,55,371 ha followed by Pavagada and Gubbi. Half of the total geographical area (50.9 percent) in the district is net area sown. Gross cropped area is 5,75,233 ha. The area sown more than once is 3.1% of the total geographical area and nearly 6% of the gross cropped area in the district. The current follow is about 7% of the total geographical area. The district has 1,28,879 ha under permanent pastures which is 12.1 percent of the total area The area under forest is 44,985 ha which is hardly about 4.1 percent of the total land. Tiptur, Tumkur and Turuvekere taluks have very small area under forest vegetation.

3.2 Crops

Ragi (Finger millet) and paddy are the major cereal crops grown in the district About 34.20 per cent area was covered by ragi during 1986-87; this was reduced to 30.59 per cent during the next decade of 1997-98, and paddy has increased from 4.50 per cent during 1986-87 to 6.10 per cent during 1997-98 Pulses occupied 13.50 per cent of the net sown area during 1986-87 and it was reduced to 10.41 per cent during 1997-98. Amongst oil seeds groundnut was grown in about 20.8.0 per cent during 1986-87, which increased to about 22.18 per cent during 1997-98 of the net sown area. It is grown on large scale in Pavagada, Madhugiri, Koratagere, and Sira taluks while coconut plantations are extensive in Chikkanayakanahalli, Tiptur, Turuvekere and Gubbi taluks. Tur though cultivated in all taluks as a mixed crop occupies a very small area (Table 3).

Table 2. Land Use of Tumkur District, Karnataka (Area in ha) (1997-98)

Taluk	TGA	Land area not available for cultivation				Other land not cultivated				Fallow land			
		Forest land	Non-cultivable	Other barren land	Total	Barren land fit for agriculture	Pastue land	Trees and plantation	Total	Current	Other	Total	Net Sown Area
C.N.halli	112998	8235	6720	7773	14493	19664	5854	2710	28228	6585	433	7018	56640
Gubbi	122057	10090	17342	4971	22313	2731	12582	2750	18063	11924	2484	14408	59523
Koratagere	70919	3476	4261	5013	9274	2749	11530	298	14577	4604	1700	6304	40281
Kunigal	99110	6594	6398	6228	12626	11873	6483	154	18510	3961	1240	5201	58280
Madhugiri	112119	3279	8969	12670	21639	8953	7100	2082	18135	18655	10422	29077	44189
Pavadada	135849	5875	7173	6180	13353	5628	7754	505	13887	39656	6576	46232	57763
Sira	155377	5452	10289	19197	29486	8151	20650	2506	31307	38238	1019	39257	55175
Tiptur	76510	595	6883	372	7255	4216	7449	4535	16250	647	198	845	56311
Tumkur	103852	827	8715	4751	13466	1817	8442	3775	14034	5770	7188	12958	66170
Turvekere	75964	561	5889	384	6273	608	11833	776	13217	4113	5037	9150	49321
District	1064755	44984	82639	67539	150178	66390	99677	20141	186208	154153	36297	170450	543663

Table 3.Distribution of major crops in Tumkur District, Karnataka

Crop	Area in (ha) (1986-1987)	% of net area sown	Area in (ha) (1997-1998)	% of net area sown
Paddy	22870	04.50	33188	6.10
Ragi	172572	34.20	166346	30.59
Jowar	3570	0.70	6421	1.18
Bajra	3170	0.60	4002	0.73
Wheat	230	0.05	1723	0.32
Minor Millets	22007	4.40	-	-
Gram	753	0.15	754	0.14
Tur	8138	1.60	9119	1.68
Other pulses	68047	13.50	51356	10.41
Sugarcane	2246	0.40	1723	0.32

Source: Tumkur at a glance 1988-89 and 1998-99, Statistical Officer, Tumkur

3.3 Perspective Land Use

Figures 3 and 4 depict a perspective view of the land use pattern in the district. The northern part of the district (Pavagada, Madhugiri, Sira and Koratagere taluks) has a distinct land use pattern of paddy in the low lands and groundnut in the uplands. The western part of the district (Chiknayakanahalli, Tiptur, Turuvekere and Gubbi taluks) has coconut in the low lands and ragi in the uplands

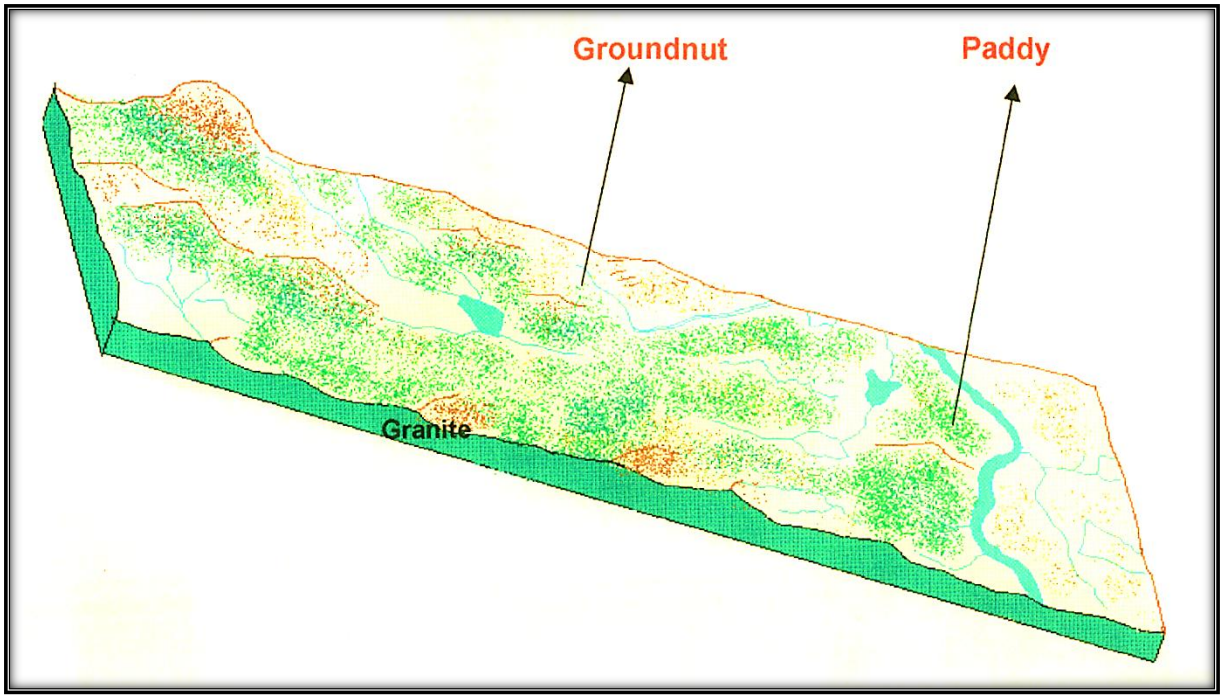


Fig: 3 Perspective view: Land use-Pavagada area

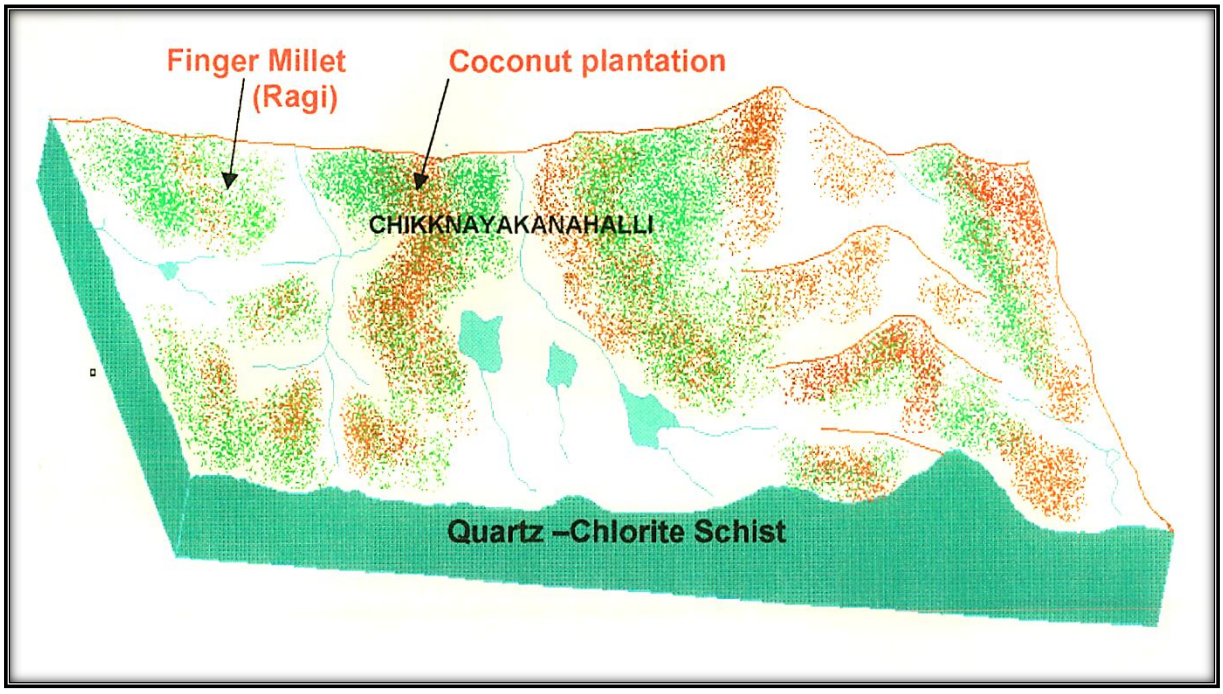


Fig: 4 Perspective view: Land use-Chikkanayakammahalli Area

4.

SOILS

4.1 Soil Survey Technique

Reconnaissance soil survey and mapping was carried out adopting the standard soil survey procedures laid down in the Soil Survey Manual (A.I.S.L.U.S, 1970) The Survey of India toposheets of scale 1:63,360 were used as base maps at taluk level. Aerial photographs of scale 1:60,000 (approx.) were used for preparing the physiography map of the district. Field investigations included study of physiography and soils in selected areas and developing correlation between physiography and soils. Traverses were conducted in other areas to supplement the correlation established and to map the soil series associations. The soil map showing the series associations has been prepared. In all 37 soil series were identified and mapped as 30 soil mapping units. The 30 mapping units have inclusions of other soils to the tune of 15 to 20 per cent.

4.2 Soils

The soils of Tumkur district occur in different physiographic units such as undulating hills and summits, undulating to rolling upper pediments, gently to very gently sloping lower pediments, valleys and floodplain. In the development of these soils, climate, relief and parent material have played a dominant role.

Major characteristics of the soil series associations observed on different physiographic positions and their classification are given in Table 4. Soil samples were collected from profiles representative of soil series and analysed for their physical and chemical properties. The data are presented in Table 5. A close relationship exists between physiography and soils and it can be observed in Figures 5, 6, 7 and 8.

The soils are moderately deep on undulating summits with rock outcrops, because of slope and moderate to severe erosion. Very deep soils occur in undulating to rolling upper pediments where the slopes and erosion are less. The soils are very deep in gently sloping to very gently sloping lower pediments due to gentle slopes and slight erosion. The soils are very deep in floodplains and valleys because of colluvio alluvial deposition by the rivers and streams. The pediments have colours in hue of 7.5YR and 2.5YR whereas the valley soils have 10YR colours due to moisture. Soil structure is well developed in all the soils.

The gravel (>2mm) content in the soils of the upper pediments of granite, granite gneiss and schistose landscapes increases with depth. Clay distribution in these soils indicates accumulation of clay in the B-horizon. These soils are neutral to medium acid whereas valley and floodplain soils are mildly to moderately alkaline.

4.3 Physiography and Soils

Major portion of the area (72.2%) of the district is occupied by soils developed on granites and granite gneiss, and 27.8% by those developed on quartzite and schists. The soils occurring on these thee landscapes identified in the district are briefly described below, and the soil map is presented in soil series association map (Fig.9) and the physiography and soils legend in Table 4 (Soil map on 1:125,000 scale is appended in the pouch).

4.3.1 Soils of Granite and Granite gneiss Landform

This landscape covers the major portion of the district and is characterized by undulating summits, tors, domes, undulating to rolling upper pediments, gently to very gently sloping lower pediments, very gently sloping to almost flat valley and very gently sloping river flood plains. The soil mapping units are briefly described below.

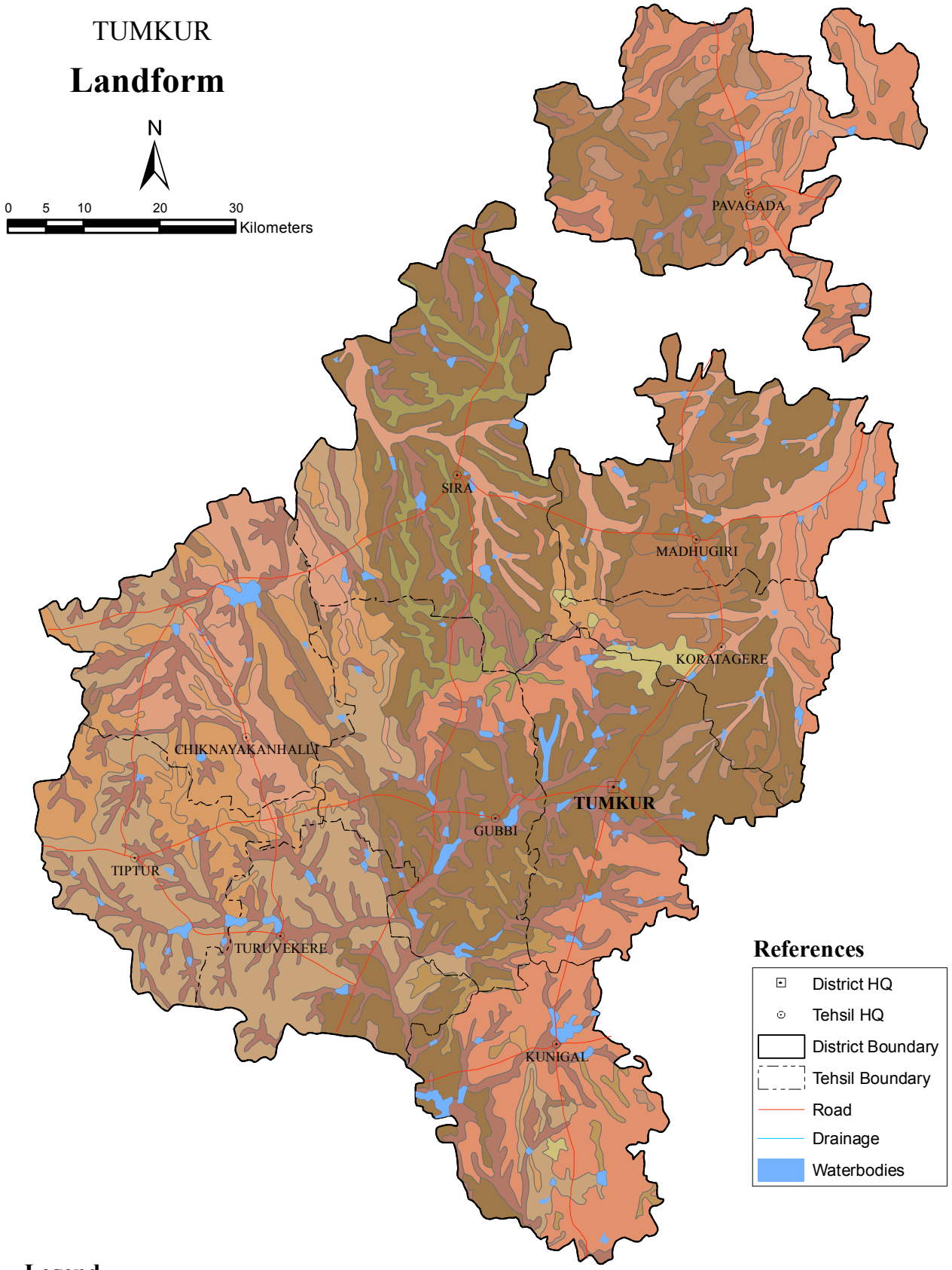


Fig. 5: Landform

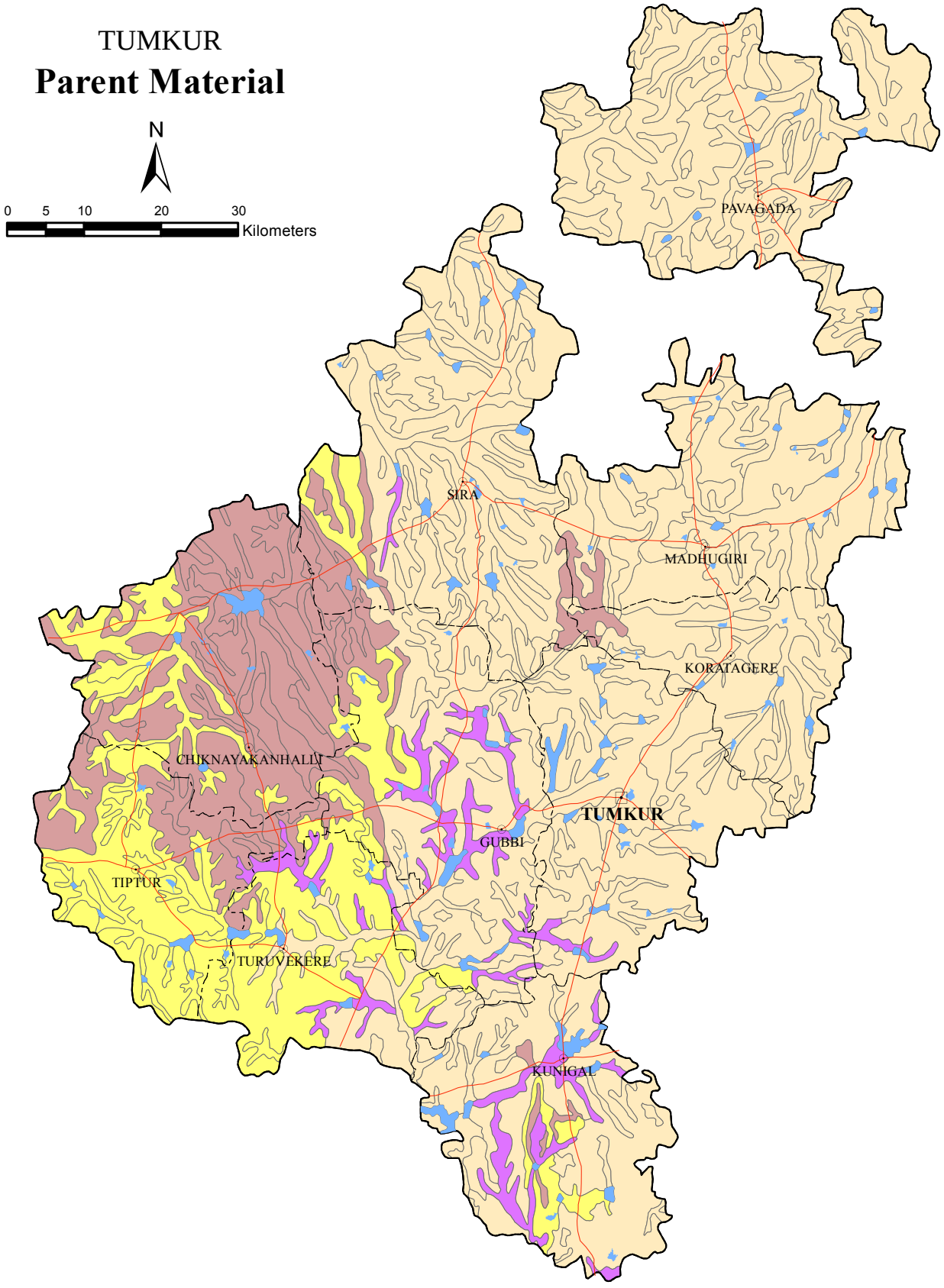


Fig. 6: Parent Material

Table 4. Physiography and soils in Tumkur District, Karnataka

Physiography	Map symbol	Soil series association	Description	Classification	Area Ha (%)
GRANITE AND GRANITE GNEISS LANDSCAPE					
Undulating summits with tors & domes	1	Bare rock outcrops	Miscellaneous land type with granite rock outcrop		23003 (2.2)
Undulating to rolling upper pediments	2	Rock outcrops	Miscellaneous land type		25023 (2.4)
		Madakasira	Moderately deep, well drained, neutral, gravelly loamy sand surface soil and neutral gravelly clay loam subsoil with cambic horizon; 40% quartz gravel, slope ranges from 5 to 10 %, moderately to severely eroded.	Loamy-skeletal Typic Haplustepts	
		Kuruganahalli	Shallow to very shallow, excessively drained, mildly acid to neutral gravelly sandy loam surface soil directly resting on weathered granite followed by hard rock at 15 an, 35 to 40 % quartz gravel; slope ranges from 3 to 10%, severely eroded.	Loamy-skeletal, Lithic Ustorthents	
	3	Dyavapatna	Very deep, well drained, strongly acid, loamy sand surface soil, and mildly to strongly acid, gravelly clay subsoil with argillic horizon; 35 to 40 % quartz gravel, slope ranges from 5 to 10%, moderately to severely eroded	Clayey-skeletal, Oxic Paleustalfs	24712 (2.3)
		Gubbi	Very deep, moderately well drained, strongly acid, sandy loam surface soil, and slightly acid sandy clay; gravelly sandy clay subsoil with argillic horizon; 25 to 30% quartz gravel, slope urges from 1 to 5%,slightly to moderately eroded.	Fine, Typic Haplustalfs	
		Rock outcrop	Miscellaneous land type		
Undulating to Rolling upper pediments	4	Madakasira	Moderately deep, well drained, neutral, gravelly loamy sand surface soil, and neutral gravelly clay loam subsoil with cambic horizon; 40% quartz gravel, slope ranges from 5 to 10%, moderately to severely eroded.	Loamy-skeletal, Typic Haplustepts	56717 (5.3)
		Kottacheruvu	Very deep, well drained, mildly acid to neutral, gravelly loamy sand surface soil, and slightly acid gravelly clay loam subsoil with argillic horizon; 50 to 60% quartz gravel, slope ranges from 3 to 10%, moderately eroded.	Loamy-skeletal, Typic Haplustalfs	
		Oblapura	Very deep, well drained, neutral, clay loam surface soil, and neutral clay subsoil, few quartz gravel, slope ranges from 3 to 5%, slightly to moderately eroded.	Fine, Typic Haplustepts	
Gently to very gently sloping lower pediments	5	Vallur	Deep to very deep. Well drained, neutral, gravelly sandy loam surface soil, and neutral gravelly sandy clay loam subsoil with cambic horizon; 30 to 35% quartz gravel, slope ranges from 2 to 3%, slightly eroded.	Loamy-skeletal, Typic Ustropepts	39300 (3.7)

Physiography	Map symbol	Soil series association	Description	Classification	Area Ha (%)
Gently to very gently sloping lower pediments		Kottacheruvu	Very deep, well drained mildly acid to neutral, gravelly loamy sand surface soil, and slightly acid gravelly clay loam subsoil with argillic horizon; 50 to 60% quartz gravel, slope ranges from 3 to 10%, moderately eroded.	Loamy-skeletal, Typic Haplustalfs	
Gently to very gently sloping lower pediments	**6**	Gubbi	Very deep, moderately well drained, strongly acid, sandy loam surface soil, and slightly acid sandy clay, gravelly sandy clay subsoil with argillic horizon; 25 to 30% quartz gravel, slope ranges from Ito 5%, slightly to moderately eroded.	Fine, Typic Haplustalfs	22397 (2.1)
		Dyavapatna	Very deep, well drained, strongly acid loamy sand surface soil, and mildly to strongly acid, gravelly clay subsoil with argillic horizon; 35 to 40 % quartz gravel, slope ranges from 5 to 10%, moderately to severely eroded.	Clayey-skeletal, Oxic Paleustalfs	
		Kottacheruvu	Very deep, well drained, mildly acid to neutral, gravelly loamy sand surface soil, and slightly acid gravelly clay loam subsoil with argillic horizon; 50 to 60% quartz gravel, slope ranges from 3 to 10%, moderately eroded.	Loamy-skeletal. Typic Haplustalfs	
Gently to very gently sloping lower pediments	**7**	Kottacheruvu	Very deep, well drained, mildly acid to neutral, gravelly loamy sand surface soil, and slightly acid gravelly clay loam subsoil with argillic horizon; 50 to 60% quartz gravel, slope ranges from 3 to 10%, moderately eroded.	Loamy-skeletal, Typic Haplustalfs	105238 (9.9)
		Madakasira	Moderately deep, well drained, neutral, gravelly loamy sand surface soil, and neutral gravelly clay loam subsoil with cambic horizon; 40% quartz gravel, slope ranges from 5 to 10%, moderately to severely eroded.	Loamy-skeletal, Typic Haplustepts	
		Dyavapatna	Very deep, well drained, strongly acid loamy sand surface soil, and mildly to strongly acid, gravelly clay sub soil with argillic horizon; 35 to 40% quartz gravel, slope ranges from 5 to 10 %, moderately to severely eroded.	Clayey-skeletal Oxic Paleustalfs	
Gently to very gently sloping lower pediments	**8**	Brahmanapalle	Very deep, moderately well drained, neutral to slightly acid, sandy clay loam surface soil, and neutral to slightly acid, clay subsoil with argillic horizon; few rounded iron concretions, slope ranges from 3 to 5% moderately to severely eroded.	Fine, Typic Haplustalfs	20848 (2.0)
		Kottacheruvu	Very deep, well drained, mildly acid to neutral, gravelly loamy sand surface soil, and slightly acid gravelly clay loam subsoil with argillic horizon; 50 to 60% quartz gravel, slope ranges from 3 to 10%, moderately eroded.	Loamy-skeletal Typic Haplustalfs	
Gently to very gently sloping lower pediments	**9**	Kadamalkunte	Deep, well drained, mildly alkaline, sandy loam surface soil, and mildly alkaline gravelly clay loam subsoil with cambic horizon; 40 to 50% quartz gravel, slope ranges from 2 to 3%, slightly eroded.	Loamy-skeletal, Typic Haplustepts	**15933 (1.5)**

Physiography	Map symbol	Soil series association	Description	Classification	Area Ha (%)
		Vallur	Deep to very deep, well drained, neutral, gravelly sandy loam surface soil, and neutral gravelly sandy clay loam subsoil with cambic horizon; 30 to 35% quartz gravel, slope ranges from 2 to 3%, slightly eroded.	Loamy skeletal, Typic Haplustepts	
		Bugadur	Shallow, well drained, mildly alkaline, sandy clay surface soil, and mildly alkaline gravelly clay subsoil with cambic horizon, few quartz gravel and abundant lime concretions, slope ranges upto 5%, slightly eroded.	Clayey, Lithic Haplustepts	
Gently to very gently sloping lower pediments	10	Arasikere	Deep, well drained, neutral gravelly sandy loam surface soil, and medium acid to neutral sandy clay subsoil, with argillic horizon; 35 to 40% quartz gravel, slope ranges from 2 to 3%, moderately eroded.	Clayey skeletal, Typic Rhodustalfs	4242 (0.4)
		Kottacheruvu	Very deep, well drained, mildly acid to neutral, gravelly loamy sand surface soil, and slightly acid gravelly clay loam subsoil with argillic horizon; 50 to 60% quartz gravel. slope ranges from 3 to 10%, moderately eroded.	Loamy-skeletal Typic Haplustalfs	
Very gently sloping to almost flat valleys (Tank command areas)	11	Lakkanpalya	Very deep, poorly drained, neutral, clay surface soil, and neutral to mildly alkaline, mottled clay subsoil, very few iron concretions; slope ranges from 1 to 2%, slightly to no erosion.	Fine, Typic Haplustepts	40523 (3.8)
		Nitta	Very deep, imperfectly drained, neutral, sandy clay loam surface soil, and mildly to moderately alkaline calcareous, clay subsoil; few iron and many lime concretions; slope ranges from 0 to 2 %, slight or no erosion.	Fine, (calcareous). Typic Ustorthents	
Very gently sloping to almost flat valleys (Tank command areas)	12	Peddamanuturu	Very deep, poorly drained, strongly alkaline, calcareous, clay loam surface soil, moderately to strongly alkaline, calcareous, sandy clay loam subsoil; few quartz gravel, slope ranges from 0 to 1 %, slight or no erosion.	Fine loamy (calcareous), Typic Haplaquents	18466 (1.7)
		Channakesavapuns	Very deep, poorly drained, slightly acid, slightly calcareous, sandy clay surface soil, mildly alkaline, clay mottled subsoil, slope ranges from 0 to 1%, slight or no erosion.	Fine, Aquic Ustifluvents	
Very gently sloping river flood plains	13	Jayamangli	Very deep, well drained, neutral, sandy loam surface soil, neutral buried sandy loam sub soil, few quartz gravel, slope ranges from 1 to 2%, slightly to moderately eroded.	Fine loamy, Typic Ustifluvents	54813 (5.2)
		Karidasanahalli	Very deep, poorly drained, moderately alkaline, calcareous, clay surface soil, moderately	Fine, (calcareous) Typic Ustifluvents	

			alkaline, mottled clay sub soil, slope ranges from I to 2%, slight or no erosion.		
Very gently sloping river flood plains	14	Pennar	Very deep, excessively drained, neutral, coarse loamy sand surface soil, neutral fine sandy clay loam subsoil, slope ranges from 1 to 2%, slightly eroded.	Coarse loamy, Typic Ustifluvents	5064 (0.5)
		Roppam	Very deep, moderately well drained, strongly alkaline, sandy loam surface soil, strongly alkaline, strongly calcareous, sandy clay subsoil, slope ranges less than 2%, slightly eroded.	Fine (calcareous), Typic Ustifluvents	
Physiography	**Map symbol**	**Soil series association**	**Description**	**Classification**	**Area Ha (%)**
Very gently sloping river flood plains		Kumudvati	Very deep, poorly drained, midly alkaline, clay surface soil, mildly alkaline clay subsoil, slope ranges from less than 2%, slightly eroded.	Fine, Typic Ustorthents	
Undulating to gently sloping upper Pediments	15	Hospura	Deep, well drained, slightly acid, sandy clay loam surface soil and neutral, clay to gravelly clay subsoil with cambic horizon, 35 to 48% quartz gravel, slope ranges from 3 to 10%, moderately eroded.	Clayey-skeletal Typic Haplustepts	28053 (2.6)
		Kuruganahalli	Shallow to very shallow, excessively drained, mildly acid toneutral, sandy loam surface soil directly resting on weathered granite and abundant loose material followed by hard rock at 15 an; 35 to 40% quartz gravel, slope ranges from 3 to 10%, severely eroded.	Loamy-skeletal, Lithic Ustorthents	
Undulating to gently sloping upper Pediments	16	Ankalakoppa	Deep, well drained, mildly acid, sandy clay loam surface soil, medium to slightly acid, clay and gravelly clay subsoil with argillic horizon; 35 to 40 % quartz gravel, slope ranges from 3 to 10% at times 15%, moderately to severely eroded.	Clayey-skeletal, Typic Haplustalfs	14224 (1.3)
		Hospura	Deep, well drained, slightly acid, sandy clay loam surface soil and neutral, clay to gravelly clay subsoil with cambric horizon, 35 to 48% quartz gravel, slope ranges from 3 to 10%, moderately eroded.	Clayey-skeletal, Typic Haplustalfs	
Gently to very gently sloping lower pediments	17	Mare	Very deep, well drained, neutral sandy loam surface soil and neutral to gravelly clay subsoil with argillic horizon; 20 to 25% quartz gravel and many, iron concretions, slope ranges from 1 to 3 %, moderately eroded.	Fine, Oxic Rhodustalfs	101064 (9.5)
		Dyavapatna	Very deep, well drained, strongly acid, loamy sand surface soil, and mildly to strongly acid, gravelly clay subsoil with argillic horizon; 35 to 40 % quartz gravel, slope ranges from 5 to 10%, moderately to severely eroded.	Clayey-skeletal, Oxic Paleustalfs	

		Gubbi	Very deep, moderately well drained, strongly acid, sandy loam surface soil, and slightly acid sandy clay loam, gravelly sandy clay subsoil with argillic horizon; 25 to 30% quartz gravel, slope ranges from 1 to 5%, slightly to moderately eroded.	Fine, Typic Haplustalfs	
Gently to very gently sloping lower pediments	18	Kadabagere	Very deep, well drained, medium acid, clay loam surface soil and strongly acid clay subsoil with argillic horizon; very few rounded iron concretions, slope ranges from 2 to 5% moderately eroded.	Fine, Oxic Rhodustalfs	80682 (7.6)
		Shettikere	Deep, well drained, neutral, gravelly sandy loam surface soil, and neutral, sandy clay followed by sandy clay loam subsoil with argillic horizon; 50 to 60% quartz gravel, slope ranges from 3 to 5%, moderately eroded.	Loamy-skeletal, Typic Rhodustalfs	
		Dyavapatna	Very deep, well drained, strongly acid Loamy sand surface soil, and mildly to strongly acid, gravelly clay subsoil with argillic horizon; 35 to 40% quartz gravel, slope ranges from 5 to 10%, moderately to severely eroded.	Clayey- skeletal, Oxic Paleustalfs	

Physiography	**Map symbol**	**Soil series association**	**Description**	**Classification**	**Area Ha (%)**
Gently to very gently sloping lower pediments	19	Madihalli	Very deep, well drained, neutral, sandy loam surface soil and neutral clay sub soil with cambic horizon; few quartz gravel and few round soft iron concretions, slope ranges from 3 to 5 %, moderately to severely eroded.	Fine, Typic Haplustepts	23727 (2.2)
		Dyavapatna	Very deep, well drained, strongly acid loamy sand surface soil, and mildly to strongly acid, gravelly clay subsoil with argillic horizon; 35 to 40% quartz gravel, slope ranges from 5 to l0%, moderately to severely eroded.	Clayey- skeletal, Oxic Paleustalfs	
Very gently sloping broad	20	Nittur	Very deep, imperfectly drained, neutral, snady clay loam surface soil, and mildly to moderately alkaline, calcareous clay subsoil; few iron and many lime concretions; slope ranges from 0 to 2 %, slight or no erosion.	Fine (calcareous), Typic Ustorthents	37710 (3.5)
		Kanatur	Very deep, poorly drained, mildly alkaline, calcareous, clay loam surface soil, and strongly alkaline, mottled calcareous, sandy clay loam subsoil; few lime concretions, slope ranges from 1 to 3%, slight or no erosion.	Fine loamy, Aquic Ustorthents	

valley		Lakkanpalya	Very deep, poorly drained, neutral, clay surface soil, and neutral to mildly alkaline, mottled day subsoil, very few iron concretions; slope ranges	Fine, Typic Haplustepts	
Very gently sloping River flood plains	21	Shimsha	Very deep, well drained, neutral sandy loam surface soil and neutral day loam and gravelly loam mottled subsoil; few round water worn pebbles, slope ranges from 1 to 2%, slightly to moderately eroded.	Fine-loamy, Typic Ustifluvents	11327 (1.1)
		Nittur	Very deep, imperfectly drained, neutral, snady clay loam surface soil, and mildly to moderately alkaline calcareous, clay subsoil; few iron and many lime concretions; slope ranges from 0 to 2 %, slightly or no erosion.	Fine,(calcareous), Typic Ustorthents	
		Lakkanpalya	Very deep, poorly drained, neutral, clay surface soil, and neutral to mildly alkaline, mottled clay subsoil, very few iron concretions; slope ranges from 1 to 2%, slightly to no erosion.	Fine, Typic Haplustepts	

QUARTZITE AND SCHIST LANDSCAPE

Undulating hills	22	Unnala	Shallow, well drained, neutral gravelly sandy loam surface soil, and neutral gravelly clay subsoil with cambic horizon; 35 to 40% quartz gravel, slope ranges from 3 to 10%, moderately to severely eroded.	Clayey-skeletal, Lithic Haplustepts	15776 (1.5)
		Sivasandra	Very shallow, excessively drained, moderately alkaline gravelly sandy clay loam surface soil of 20 cm resting on hard crust with many pisolitic iron manganese concretions 50% to 65% mixed with weathered quartzite, slope ranges from 3 to 15% moderately severely eroded.	Loamy-skeletal, Lithic Ustorthents	

Physiography	**Map symbol**	**Soil series association**	**Description**	**Classification**	**Area Ha (%)**
		Matha	Moderately deep, well drained, gravelly sandy clay loam surface soil, and neutral, calcareous sandy clay loam subsoil overlying weathered calcareous amphibolite schist; 25 to 30% quartz gravel, slope ranges from 3 to 10%, moderately to severely eroded.	Fine loamy (calcareous), Typic Ustorthents	
Gently sloping upper pediments	23	Honnavalli	Moderately deep, well drained, slightly acidto neutral gravelly sandy loam surface soil, and medium acid sandy clay to gravelly clay subsoil with cambic horizon; 50 to 55% quartz gravel, many rounded iron concretions, slope ranges from 3 to 10%,	Clayey-skeletal, Typic Haplustepts	18446 (1.7)

			moderately to severely eroded.		
		Virapuram	Moderately deep to deep, well drained. Mildly alkaline, gravelly sandy clay loam surface soil, and neutral gravelly clay subsoil with cambic horizon; 35 to 45% quartz gravel, slope ranges from to 3 to 8% severely eroded.	Clayey-skeletal, Typic Haplustepts	
		Unnala	Shallow, well drained, neutral gravelly sandy loam surface soil, and neutral gravelly clay subsoil with cambic horizon; 35 to 40% quartz gravel, slope ranges from 3 to 10%, moderately to severely eroded.	Clayey-skeletal Lithic Haplustepts	
Gently sloping upper pediments	24	Virapuram	Moderately deep to deep, well drained, mildly alkaline, gravelly sandy clay loam surface soil, and neutral, gravelly clay subsoil with cambic horizon; 35 to 45% quartz gravel, slope ranges from to 3 to 8%, severely eroded.	Clayey-skeletal, Typic Haplustepts	55816 (5.2)
		Doddaguni	Very deep, well drained, mildly acid, clay surface soil, and slightly acid, clay to gravelly clay subsoil with argillic horizon; 30 to 35% iron and quartz gravel, slope ranges from 3 to 10%, moderately to severely eroded.	Fine, Typic Rhodustalfs	
		Honnavalli	Moderately deep, well drained, slightly acid to neutral, gravelly sandy loam surface soil, and medium acid sandy clay to gravelly clay subsoil with cambic horizon; 50 to 55% quartz gravel, many rounded iron concretions, slope ranges from 3 to 10%, moderately to severely eroded.	Clayey-skeletal, Typic Haplustepts	
Gently sloping upper pediments	25	Doddaguni	Very deep, well drained. Mildly acid, clay surface soil, and slightly acid, clay to gravelly clay subsoil with argillic horizon; 30 to 35% iron and quartz gravel, slope ranges from 3 to 10%, moderately to severely eroded.	Fine, Typic Rhodustalfs	45927 (4.3)
		Virapuram	Moderately deep to deep, well drained, mildly alkaline, gravelly sandy clay loam surface soil, and neutral, gravelly clay subsoil with cambic horizon; 35 to 45% quartz gravel, slope ranges from to 3 to 8%, severely eroded.	Clayey-skeletal, Typic Haplustepts	
Very gently sloping lower pediments	26	Doddaguni	Very deep, well drained, mildly acid, clay surface soil, and slightly acid, clay to gravelly day subsoil with argillic horizon; 30 to 35% iron and quartz gravel, slope ranges from 3 to 10%, moderately to severely eroded.	Fine, Typic Rhodustalfs	98541 (9.3)

Physiography	Map symbol	Soil series association	Description	Classification	Area Ha (%)
		Kadabagere	Very deep, well drained, medium acid, clay loam surface soil and strongly acid, clay subsoil with argillic horizon; very few rounded iron concretions, slope ranges from 2 to 5%, moderately eroded.	Fine, Oxic Rhodustalfs	
Very gently sloping lower pediments	27	Kodigehalli	Very deep, moderately well drained, moderately alkaline to slightly alkaline, slightly calcareous, clay surface soil and mildly alkaline, calcareous, clay subsoil with cambic horizon; many irregular lime and iron concretions, slope ranges from 2 to 5%, slightly eroded.	Fine (calcareous), Typic Haplustept	2276 (0.2)
		Doddaguni	Very deep, well drained, mildly acid, clay surface soil, and slightly acid, clay to gravelly clay subsoil with argillic horizon; 30 to 35% iron and quartz gravel, slope ranges from 3 to 10%, moderately to severely eroded.	Fine, Typic Rhodustalfs	
Very gently sloping lower pediments	28	Sim	Shallow, moderately well drained, neutral, calcareous clay surface soil, and mildly alkaline calcareous clay subsoil overlying weathered parent material at 30 cm, slope ranges from 1 to 5%, moderately eroded.	Clayey (calcareous), Lithic Ustorthent	3517 (0.3)
		Kodigehalli	Very deep, moderately well drained, moderately alkaline to slightly alkaline, slightly calcareous, clay surface soil and mildly alkaline, calcareous, clay subsoil with cambic horizon; many irregular lime and iron concretions, slope ranges from 2 to 5%, slightly eroded.	Fine (calcareous), Typic Haplustept	
Very gently sloping to almost flat valleys	29	Kanatur	Very deep, poorly drained, mildly alkaline, calcareous clay loam surface soil, and strongly alkaline, mottled calcareous sandy clay loam subsoil; few lime concretions, slope ranges from 1 to 3%, slight or no erosion.	Fine loamy (calcareous), Aquic Ustorthent	54319 (5.1)
		Hamplapura	Very deep, imperfectly drained, neutral sandy loam surface soil, and moderately alkaline clay mottled subsoil; iron concretionary layer is met with occasionally in sub soil, slope ranges from 1 to 2%, slight or no erosion.	Fine Typic Ustorthent	
		Nittur	Very deep, imperfectly drained, neutral, sandy clay loam surface soil, and mildly to moderately alkaline calcareous, clay sub soil; few iron	Fine (calcareous), Typic Ustrothent	

			and any lime concretions; slope ranges from 0 to 2%, slight or no erosion.		
Very gently sloping to almost flat valleys	30	Hamplapura	Very deep, imperfectly drained, neutral sandy loam surface soil, and moderately alkaline clay mottled subsoil; iron concretionary layer is met with occasionally in sub soil, slope ranges from 1 to 2%, slight or no erosion.	Fine Typic Ustorthent	17071 (1.6)
		Kanatur	Very deep, poorly drained mildly alkaline, calcareous clay loam surface soil, and strongly alkaline, mottled calcareous sandy clay loam subsoil: few lime concretions, slope ranges from 1 to 3%, slight or no erosion.	Fine loamy (calcareous), Aquic Ustorthent	

Table 5 Physical and chemical characteristics of soils of Tumkur District, Karnataka

Series	**Horizon**	**Depth (cm)**	**Gravel %**	**Sand %**	**Silt %**	**Clay %**	**pH 1:2.5**	**O.C %**	**CEC meq/100g**
Ankalakoppa	Ap	0-13	18.3	73.8	3.0	23.2	5.6	0.41	4.0
	Bt1	13-25	9.9	54.4	4.3	41.3	5.4	0.51	9.7
	Bt2	25-41	25.0	42.7	6.1	51.2	5.7	0.54	12.8
	Bt3	41-68	57.3	45.2	7.4	47.4	6.0	0.48	13.7
Arasikere	Ap	0-14	42.8	78.8	4.5	16.7	6.6	0.19	6.9
	Bt1	14-28	53.3	60.5	5.7	33.8	6.0	6.0	0.48
	Bt2	28-60	63.1	23.8	7.0	69.2	5.7	0.54	21.9
	Bt3	60-85	59.4	33.4	8.4	58.2	6.1	0.48	23.3
Bidare	Ap	0-13	0.9	77.1	4.2	18.7	6.6	0.09	6.5
	Bt1	13-54	0.9	44.3	10.7	45.0	6.0	0.38	7.7
	Bt2	54-117	5.1	44.3	18.8	36.9	6.3	0.32	7.8
	BC	117-164	57.0	38.8	16.1	45.1	7.0	0.16	9.5
Brahmanapalle	Ap	0-15	3.7	72.4	4.8	22.8	6.7	0.19	5.7
	Bt1	15-48	0.2	38.1	7.2	54.7	6.3	0.25	11.5
	Bt2	48-85	0.2	35.4	6.4	58.2	6.3	0.32	12.2
	Bt3	85-150	0.1	44.1	12.8	43.1	6.2	0.34	15.7
Bugadur	Ap	0-10	18.1	65.5	11.0	23.5	7.8	0.31	25.6
	A2	10-20	2.6	59.2	13.4	27.4	7.5	0.52	34.7
	Bw	20-30	39.7	48.9	14.7	36.4	7.5	0.52	29.9
	BC	30-44	33.3	53.1	12.5	34.4	7.5	0.43	24.9
Chennakesavap-ura	Ap	0-11	6.5	57.6	7.2	35.2	6.3	0.90	20.5
	2C1	11-24	5.6	22.1	20.8	57.0	7.1	0.71	19.3
	2C2	24-59	5.6	28.1	25.2	46.7	7.0	0.34	21.6
	2C3	59-92	4.4	23.0	25.8	51.2	6.9	0.37	21.2
	2C4	92-145	3.8	25.4	24.9	49.7	7.2	0.62	22.2

Doddaguni	Ap	0-11	-	44.1	12.8	43.1	5.5	0.62	17.9
	Bt1	11-52	-	29.5	12.6	57.9	5.6	0.83	30.5
	Bt2	52-106	-	25.9	13.0	61.1	5.6	0.77	34.5
	Bt3	106-141	67.6	35.7	13.6	50.7	5.9	0.37	29.5

Dyavapatna	Ap	0-15	6.6	84.0	2.7	13.3	5.5	0.14	2.6
	A2	15-38	5.1	78.0	4.7	17.3	5.6	0.14	3.1
	Bt1	38-67	42.4	66.0	4.7	29.3	5.4	0.22	5.8
	Bt2	67-152	62.7	48.0	8.7	43.3	5.5	0.14	7.9

Gubbi	Ap	0-13	4.1	78.7	7.1	14.2	6.1	0.45	-
	Bt1	13-43	1.8	56.3	6.8	36.9	6.0	0.21	7.5
	Bt2	43-80	11.6	55.0	9.6	35.4	6.0	0.12	12.5
	2Bt3	80-123	44.4	57.3	10.2	32.5	5.9	0.21	9.7
	3B3	123-170	8.9	64.7	11.6	23.7	5.7	0.30	8.3

Honnavalli	Ap	0-15	34.5	82.7	2.6	14.7	6.1	0.18	11.5
	Bw	15-32	13.1	63.3	4.1	32.6	5.9	0.27	13.0
	BC	32-81	62.1	49.1	14.8	36.1	6.2	0.24	14.1

Series	**Horizon**	**Depth (cm)**	**Gravel %**	**Sand %**	**Silt %**	**Clay %**	**pH 1:2.5**	**O.C %**	**CEC meq/100g**
Hamplapura	Ap	0-18	7.4	83.4	4.0	12.6	7.0	0.27	3.4
	A2	18-60	2.9	68.2	6.4	25.4	7.7	0.27	6.7
	2C1	60-96	15.5	46.2	11.6	42.2	7.6	0.18	10.2
	3C2	96-146	9.4	44.2	9.8	46.0	7.9	0.18	9.6
	4C3	146-163	5.2	47.7	12.3	40.0	8.0	0.22	10.4

Hospura	Ap	0-15	1.7	68.6	7.8	23.6	6.6	0/42	14.4
	Bw 1	15-30	2.3	44.6	9.8	45.6	6.1	0.30	18.7
	Bw2	30-45	60.5	46.5	11.5	42.0	6.9	0.39	18.0
	2Bw3	45-85	16.3	52.1	16.7	31.2	-	0.45	17.8

Jayamangali	Ap	0-25	1.9	73.1	8.0	18.9	6.5	0.21	10.3
	Bw	25-48	2.9	68.0	8.8	23.2	6.4	0.33	11.0
	2A1	42-62	4.9	78.9	4.4	16.7	6.5	0.06	9.1
	2A2	62-85	5.2	75.9	6.4	17.7	6.5	0.18	7.4
	2A3	85-120	3.8	73.9	6.0	20.1	6.4	0.03	8.4

Kadabagere	Ap	0-12	1.8	62.0	8.0	30.0	5.6	0.33	10.2
	Bt1	12-25	1.5	48.3	8.1	43.6	5.1	0.54	8.7
	Bt2	25-102	8.3	53.4	8.1	38.5	5.1	0.24	8.8

Kadamalakunte	Ap	0-13	51.6	72.9	9.4	17.7	7.5	0.09	9.7
	Bw1	13-39	60.8	Na	Na	Na	7.6	Na	Na
	Bw2	39-80	65.5	Na	Na	Na	7.6	Na	Na
	C	80-110	85.1	Na	Na	Na	7.6	Na	Na

Kanatur	Ap	0-12	11.4	56.7	9.2	34.1	7.5	0.81	10.9
	A2	12-32	14.4	54.2	10.5	35.3	7.8	0.66	12.1
	2C1	32-58	13.4	67.4	7.3	25.3	8.5	0.40	10.8
	2C2	58-88	12.5	63.7	8.3	28.0	8.5	0.40	9.8
	2C3	88-102	11.6	66.9	5.0	28.1	8.6	0.37	14.3

Karidasanahalli	Ap	0-18	9.7	31.0	19.9	49.1	8.4	0.51	24.0
	A2	18-54	7.1	35.1	16.0	48.9	8.3	0.03	20.0
	A3	54-100	11.7	46.9	12.9	40.2	8.0	0.12	21.5
	2C	100-140	1.6	52.2	12.1	35.7	8.0	0.33	15.3

Kodigehalli	Ap	0-19	1.9	22.2	28.4	49.4	7.9	0.57	44.7
	Bw1	19-75	3.1	19.4	22.3	58.3	7.8	0.39	44.6
	Bw2	75-131	12.3	18.5	22.2	59.3	7.7	0.44	48.0

Kollacheruvu	Ap	0-10	29.6	90.2	4.6	5.2	6.5	0.06	Na
	Bt1	10-40	38.6	61.9	8.5	29.6	6.1	0.42	17.3
	Bt2	40-85	43.1	57.8	12.4	29.8	6.2	0.28	19.2
	Bt3	85-115	35.8	59.3	18.2	22.5	6.5	0.08	13.4

Kumudvati	Ap	0-23	8.2	51.2	10.4	38.4	7.4	0.48	26.2
	A2	23-60	3.0	49.8	10.3	39.9	7.5	0.22	27.4
	A3	60-105	1.6	44.1	14.5	41.4	7.4	0.08	32.5
	AC	105-150	-	58.8	10.9	30.3	7.7	0.08	19.0

Kuruganahalli	A	0-9	7.86	Na	Na	Na	6.2	0.08	4.2

Series	**Horizon**	**Depth (cm)**	**Gravel %**	**Sand %**	**Silt %**	**Clay %**	**pH 1:2.5**	**O.C %**	**CEC meq/100g**
Lakkanapalya	Ap	0-20	19.2	25.7	19.6	54.7	7.0	0.52	23.0
	A2	20-44	10.0	15.7	21.6	62.7	7.2	0.58	25.0
	A3	44-70	5.4	20.7	20.8	58.5	7.3	0.46	24.6
	2C1	70-79	29.4	73.6	4.0	22.4	7.4	0.23	13.9
	2C2	79-110	-	20.1	20.8	59.1	7.4	0.48	21.5

Madakasira	Ap	0-18	40.8	86.1	7.8	6.1	7.5	0.28	Na
	Bw1	18-40	51.6	59.1	7.8	33.1	7.3	0.41	25.3
	Bw2	40-78	42.1	63.1	6.7	30.2	6.8	0.38	15.1

Madihalli	Ap	0-7	7.1	77.1	4.8	18.1	6.8	0.43	10.3
	Bw1	7-20	6.2	69.1	4.7	26.2	6.9	0.43	12.6
	Bw2	20-67	6.7	47.1	6.8	46.1	6.9	0.58	20.0
	BC	67-110	8.9	33.0	8.9	58.1	7.4	0.17	33.5

Matha	Ap	0-23	67.3	61.1	11.8	27.1	7.8	0.66	18.5
	A2	23-45	16.6	53.4	19.8	26.8	7.1	0.35	26.2

Nittur	Ap	0-18	14.5	54.3	19.0	26.7	7.2	0.64	22.6
	A2	18-51	10.0	29.7	20.7	49.6	7.8	0.35	33.0
	A3	51-125	6.9	24.3	19.8	55.7	8.0	0.29	46.2
	A4	125-180	16.0	26.4	24.6	49.0	8.0	0.14	39.7

Oblapura	Ap	0-23	6.8	Na	Na	Na	6.5	1.39	Na
	Bw1	13-59	8.0	Na	Na	Na	6.9	0.61	Na
	Bw2	59-115	56.2	Na	Na	Na	7.1	0.40	Na

Peddamanuturu	Ap	0-19	17.5	43.5	21.9	34.6	8.7	1.39	24.7
	A2	19-34	22.6	41.2	26.6	32.2	8.4	0.61	23.9
	A3	34-61	43.1	71.2	7.5	21.3	8.6	0.41	21.3

Penmar	Ap	0-14	2.3	90.2	Na	Na	6.6	Na	Na
	A2	14-34	Na	Na	Na	Na	6.7	Na	Na
	A3	34-67	4.9	92.4	Na	Na	6.7	Na	Na
	A4	67-107	0.3	74.3	Na	Na	6.9	Na	Na
	2A3	107-130	0.8	76.6	Na	Na	7.0	Na	Na
	2A4	130-155	5.0	75.1	Na	Na	7.2	Na	Na

Ropparm	Ap	0-18	23.1	71.3	10.4	18.3	6.6	0.75	12.2
	A2	18-34	11.6	71.3	9.6	19.1	7.8	0.41	14.1
	A3	34-80	10.6	71.7	8.9	19.4	8.5	0.29	13.9
	2C1	80-113	22.6	64.6	8.4	27.0	8.8	0.41	17.5
	2C2	113-145	24.3	72.2	6.3	21.5	8.4	0.26	15.3

Shettikere	Ap	o-7	23.9	79.8	7.9	12.3	8.3	0.61	12.1
	A2	7-27	21.0	60.2	10.9	28.9	7.6	0.43	17.5
	Bt1	27-51	59.1	56.9	4.8	38.3	6.8	0.64	19.9
	Bt2	51-83	61.7	58.8	10.2	31.0	6.4	0.41	18.4

Shimsha	Ap	0-18	11.9	81.5	4.5	14.0	6.7	0.48	5.1
	A2	18-65	5.0	53.1	13.4	33.5	6.8	0.55	12.5
	2C1	65-103	14.1	52.2	18.6	29.2	7.0	0.46	12.6
	2C2	103-140	75.2	65.9	13.0	21.1	7.1	0.90.	11.7

Series	**Horizon**	**Depth (cm)**	**Gravel %**	**Sand %**	**Silt %**	**Clay %**	**pH 1:2.5**	**O.C %**	**CEC meq/100g**
Sira	A1	0-15	14.8	31.8	11.1	57.1	7.3	0 .39	50.8
	A2	15-30	18.7	40.6	10.4	49.3	8.1	0.84	52.3

Sivasamdra	A1	0-20	66.7	49.6	21.5	28.9	8.3	1.41	10.3

Unnala	Ap	0-11	65.9	64.6	17.4	18.0	7.2	1.47	10.6
	Bw1	11-24	72.2	57.1	15.6	27.3	7.0	1.26	142
	Bw2	24-42	71.7	42.4	14.4	43.2	7.0	0.66	13.9

Vallur	Ap	0-10	18.6	81.4	3.5	15.1	7.2	0.36	9.1
	Bw1	10-37	17.4	54.0	5.4	40.6	7.3	0.36	17.6
	Bw2	37-62	70.3	60.2	7.8	32.0	7.2	0.24	20.9
	Bw3	62-88	35.4	64.8	7.1	28.1	7.5	0.06	15.1

Virapuram	Ap	0-12	38.7	69.1	4.7	26.2	7.6	0.45	17.9
	Bw1	12-38	68.6	57.5	3.8	38.7	7.3	0.75	31.9
	Bw2	38-60	62.6	48.4	12.2	39.4	7.3	0.51	28.5

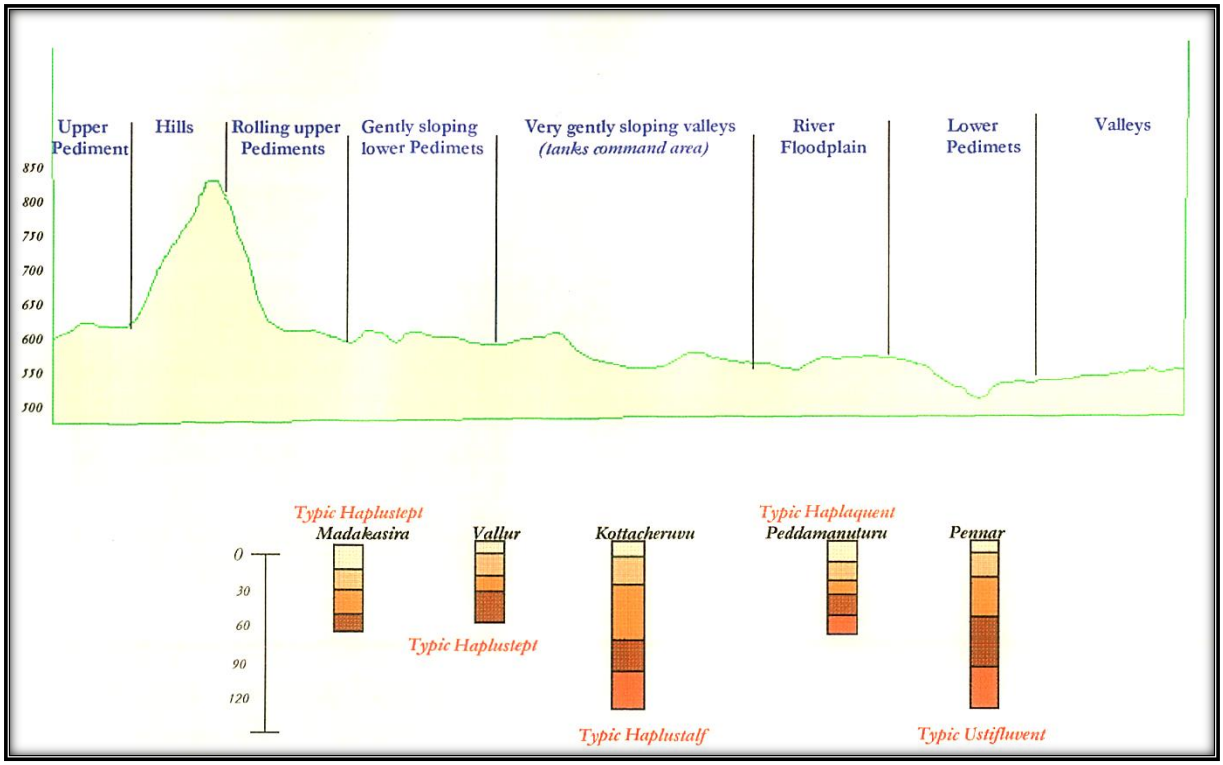


Fig: 7 Physiography and soil relationship- Granite landform

Bare Rock outcrops

These areas comprise of bare rock outcrops made up of tors and domes of granites on undulating summits with very little rock debris accumulated at the foot of the bare rocks. They may have crevices in between joints at random where some vegetation can be observed.

Rock outcrops-Madakasira-Kuruganahalli Association

This association occurs on undulating summits with bare rock outcrops of granite in large proportion. Madakasira series, which are moderately deep, red, gravelly textured soils are found in the undulating uplands with 5-10% slope. The gravel mainly consists of quartz fragments. The estimated available moisture retaining capacity is 3.9 cm in 50 cm depth. They are low in soil fertility. The surface texture is loamy sand and frequently covered with stones and cobbles. The soils are severely eroded in some places. They remain dry for major part of the year and are susceptible to drought conditions. Kuruganahalli series which are shallow to very shallow is found in undulating uplands with 5-10% slope gravelly texture soils resting on hard substrata, having very low available moisture retaining capacity, very low nutrient status and are susceptible to erosion.

Dyavapatna-Gubbi-Rock outcrops Association

Soils of this association occur on undulating to rolling upper pediments in lower reaches on 5-10% slope as very deep, red, gravelly soils representing Dyavapatna series and very deep, red, clayey soils representing Gubbi series on 2-5% slope in association with rock outcrops. Dyavapatna soils have an occasional stoneline between 40 to 60 cm. depth and 40 to 70% gravel between 40 to 80 cm depth. Estimated available moisture retaining capacity is 7.5 cm in 90 cm depth. They remain dry for major part of the year and are poor in soil fertility. Gubbi soils are yellowish red to red, clayey soils with few iron concretions in the lower depth. Estimated available moisture retaining capacity is 13 cm in 90 cm depth. They will respond to management improvement under normal conditions of rainfall. They have good soil productivity potential for cultivated crops. They remain moist in moisture control section (between 10-30 cm depth) for more than 150 days in a year.

Madakasira-Kottacheruvu-Oblapura Association

Soils of this association occur on undulating to rolling upper pediments with slopes of 5-10%. Madakasira soils are moderately deep, red, gravelly soils with low (3.9 cm) available moisture retaining capacity. Kottacheruvu soils are very deep, brown to dark brown and red gravelly soils. The available moisture retaining capacity is 13.5 cm in 90 cm depth. Surface textures are sandy to sandy loam. They are rapidly permeable and remain dry in subsoil during long spells between two showers in rainy season. Oblapura soils are very deep, red, gravelly soils. The available moisture retaining capacity is 10.5 cm for 90 cm depth

Vallur-Kottacheruvu Association

This association occurs on gently to very gently sloping lower pediments with slopes ranging from 2-5%. Vallur soils are deep, red, loamy soils with 14 to 20% quartz gravels. The available moisture retaining capacity is 10.6 cm in 90 cm depth, they are rich in available potash. Kottacheruvu are very deep, brown to dark brown and red gravelly soils.

Gubbi-Dyavapatna-Kottacheruvu Association

Soils of this association occur on gently sloping upper pediments in lower reaches on 2-5% slope as very deep, red clayey, soils representing Gubbi series, very deep, red, gravelly soils representing Dyavapatna series and very deep, brown to dark brown and red gravelly texture soils representing Kottacheruvu series. They have good potential for cultivated crops. They remain moist in the moisture control section for more than 150 days in a year and respond to application of fertilizers

Kottacheruvu-Madakasira-Dyavapatna Association

This association occurring on gently to very gently sloping lower pediments and represents very deep, brown to dark brown and red, gravelly soils of Kottacheruvu series followed by moderately deep, red, gravelly soils of Madakasira series and very deep, red, gravelly soils of Dyavapatna series. This unit has soils with high proportion of quartz gravel with moderate available moisture retaining capacity and moderately rapid permeability. These soils are low in productivity.

Brahmanapalle-Kottacheruvu Association

Soils of this association occur on gently to very gently sloping lower pediments with slopes ranging from 2-5%. Brahamanapalle soils are very deep, dark red, clayey soils with 15 cm of available moisture retaining capacity in 90 cm depth. They are slowly permeable with susceptibility to severe gully erosion. They are fertile soils and respond to fertilizer management, but require soil conservation measures. Kottacheruvu soils are very deep brown to dark brown and red gravelly soils with moderate available moisture retaining capacity.

Kadmalakunte-Vallur-Bugadur Association

Soils of this association occur on gently to very gently sloping lower pediments with 2-5% slope. Kadamalakunte soils are deep to very deep, strong brown to reddish brown, gravelly soils. They are strongly calcareous with abundant quartz and iron gravel in the subsoil. The available moisture retaining capacity is 6.5cm for 60 cm depth. Vallur soils are very deep, red to reddish brown gravelly soils with 30% quartz gravel. The available moisture retaining capacity is 10.6 cm in 90 cm depth. They are rich in available potash and poor in available phosphorous. Bugadur soils are moderately deep, brown to dark brown gravelly soils. Iron and quartz gravel occur in subsoil. They are moderately to severely eroded. The available moisture retaining capacity is 4.1 to 4.5 cm in 30 cm depth.

Arasikere-Kottacheruvu Association

This association occurs on very gently sloping lower pediments with 2-5% slope. Arasikere soils are deep, red to dark red, gravelly soils covered with pebbles, stones and gravels on the surface. Available moisture retaining capacity is 7.5 cm in 90 cm depth. They are very low in soil fertility and productivity potential is low.

Kottacheruvu soils are very deep, brown to dark brown, gravelly soils with moderate available moisture retaining capacity.

Lakkanpalya-Nittur Association

Soils of this association occur on very gently sloping to almost flat valleys and tank command areas with slopes ranging from 0 to 1%. Lakkanpalya series are very deep brown to dark brown and dark gray clayey soils in low-lying areas. They remain moist for a long time during the year. They are slowly permeable with moderately high water table. The available moisture retaining capacity is 15 cm in 90 cms depth. Nittur series are very deep, olive gray to dark olive gray silty clay to clay, calcareous soils in low-lying areas. They remain moist for long time during the year. The calculated available moisture retaining capacity is 15.2 cm in 90 cm depth.

Peddamanuturu-Chennakesavapura Association

Soils of this association occur in low land valley portion with slopes ranging from 1-2%. Peddamanutur soils are very deep, grey to very dark grey strongly calcareous soils underlain by coarse sandy loam, calcareous non-coherent material These soils have water table within 100 cm depth. The available water retaining capacity is 15.9 cm in 90 cm depth. They remain moist for a long time in most years and show cracking tendency during summer. Chennakesavapura series are very deep, brown to dark greyish brown and grey, sandy clay to clay soils with few mottles and shining ped faces with few lime concretions in the surface horizon. They are slowly permeable and remain moist below 25 cm depth. The available moisture retaining capacity is 14.9 cm for 90 cm. depth.

Jayamangali-Karidasanahalli Association

Soils of this association occur on level to nearly level flood plains of river with slope gradient of 1-2%. Jayamangli soils are very deep, dark brown, stratified alluvial soils. They are moderately to rapidly permeable. The available moisture retaining capacity ranges from 8.5 to 9 cm depth. The ground water table may be shallow to deep depending upon the season. These soils are associated with clayey, calcareous valley soils near about the flood plains. Karidasanahalli series are very deep, dark grey, alkaline, clayey soils with high water retentive capacity.

Pennar-Roppam-Kumudvati Association

Soils of this association occur on level to nearly level flood plains with slope gradients of 1-2%. Pennar soils are very deep dark brown to dark yellowish brown, stratified, slightly calcareous soils. The available water retaining capacity is 10.5 cm in 90 cm depth. Roppam soils are very deep, grayish brown sandy clay, calcareous soils with available moisture retaining capacity of 13.5 cm in 90 cm depth. They are underlined by yellowish brown, sandy loam, calcareous sediments of local streams. Kumudvati soils are very deep, grayish brown to dark grayish brown, fine loamy, and well drained, moderately permeable soils with available moisture retaining capacity of 13.5 cm in 90 cm depth.

Hospura-Kuruganahalli Association

Soils of this association occur on ridges with undulating topography with slope gradients of 10-15%. Hospura series are moderately deep yellowish red to dark brown, gravelly soils. They are low in available moisture capacity. Kuruganahalli soils are very shallow, red, gravelly soils with pebbles and gravels on surface. The available moisture retaining capacity is very low. These are very poor soils with low productivity potentiality.

Ankalkoppa-Hospura Association

Soils of this association occur on undulating to gently sloping upper pediments with 5-10% slope. Ankalkoppa series has soils, which are moderately deep to deep, red, clayey with quartz gravels and iron concretions.

Available moisture retaining capacity is 8.6 cm for 55 cm depth. Hospura series are moderately deep, yellowish red to dark brown, gravelly soils with low available moisture capacity.

Bidare-Dyavapatna-Gubbi Association

Soils of this association occur on gently to very gently sloping lower pediments with slope gradients ranging from 1 to 5%. Bidare soils are very deep, yellowish red to dark red, clayey with iron gravel and lateritic material in the subsoil. They are slowly permeable with available moisture retaining capacity of 12 cm in 90 cm depth. They are severely eroded at few places. Dyavapatna soils are very deep dark red, gravelly clay soils with moderately low available moisture retaining capacity (7.5 cm in 90 cm depth) and moderately rapid permeability. Gubbi series are very deep yellowish to red, clayey soils with 13 cm available moisture retaining capacity in 90 cm depth. They remain moist in control section for more than 150 days in a year and respond to management practices and application of fertilizers.

Kadabagere-Shettikere-Dyavapatna Association

Soils of this association occur on gently sloping upper pediments with 2-5% slope. Kadabagere soils are very deep, dark red, clayey soils and have few soft iron concretions in the lower depths. The available moisture retaining capacity is 15.5 cm in 90 cm depth. They are productive soils, which respond well to management. Shettikere soils are moderately deep to deep gravelly clay soils, which are moderately eroded. The available moisture retaining capacity is 11 cm in 90 cm depth. Dyavapatna soils are very deep, gravelly soils with low available moisture retaining capacity and moderately rapid permeability.

Madihalli-Dyavapatna Association

Soils of this association occur on gently to very gently sloping lower pediments with 2-5% slope. Madihalli series are very deep, brown to yellowish red, clayey soils with iron concretions in subsoil. The available moisture capacity is medium. Dyavapatna soils are very deep, red gravelly soils with moderately low available moisture capacity and moderately rapid permeability.

Nittur-Kanatur-Lakkanpalya Association

Soils of this association occur on valleys, tank command areas and low lands with slope gradients ranging from 1 to 2%. Nittur soils are very deep, very dark grayish brown to very dark gray, clayey, calcareous soils with high ground water table and moist subsoil for long periods. Kanatur soils are very deep, yellowish brown to brown, calcareous clayey soils with high water table and remain moist for a long time in subsurface. Brown mottles are frequently observed in the subsoil along with lime concretions. Lakkanpalya series are very deep, dark brown to dark gray, clayey soils which are slowly permeable and remain moist for a long time during the year.

Shimsha-Nittur-Lakkanpalya Association

Soils of this association occur on very gently sloping river flood plains and fringes of the reservoir irrigated areas with slope gradients ranging from 1-2%. Shimsha series are very deep, yellowish brown to dark brown, stratified soils with few lime and iron concretions in subsoil. The available moisture retaining capacity is 13.5 cm in 90 cm depth. Nittur soils are very deep, very dark grayish brown to very dark grey, clayey calcareous soils and Lakkanpalya soils are very deep, dark brown to dark grey clayey soils. They remain moist for long periods in a year.

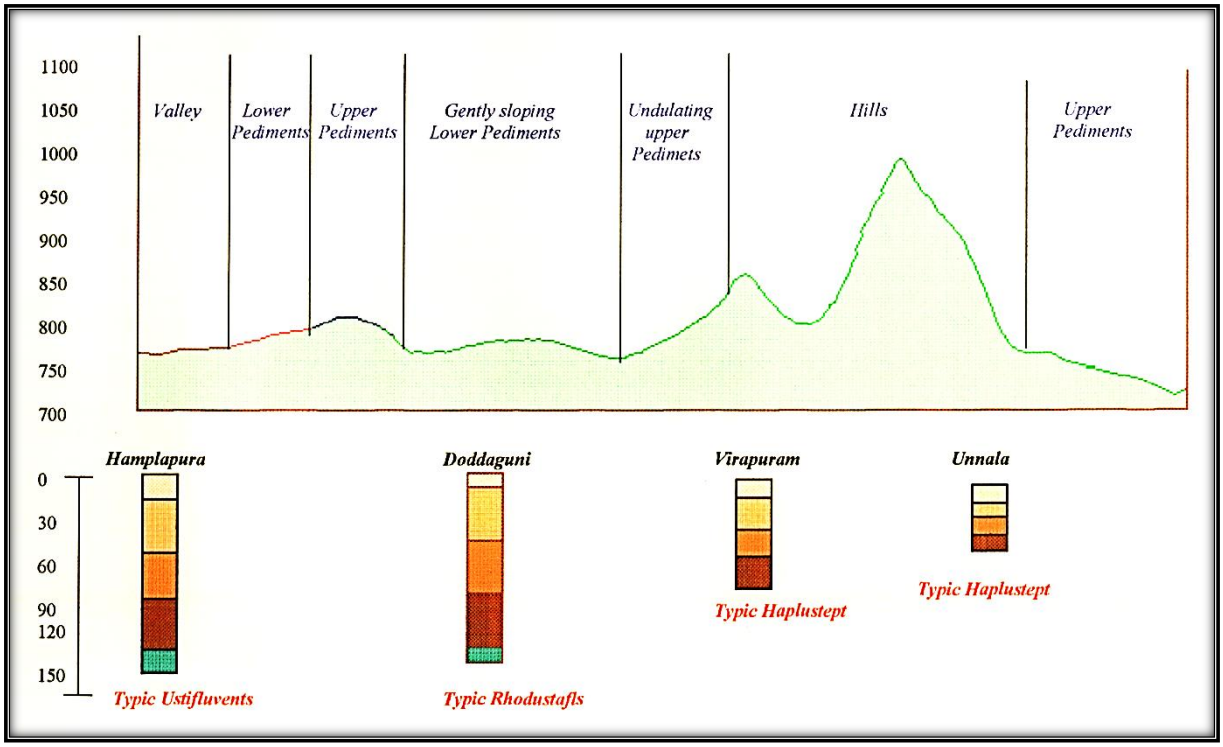


Fig: 8 Physiography and soil relationship- Schistose landform

4.3.2 Soils of quartzite and schistose landform

This landscape covers 27.9% of the area of the district and is characterized by undulating hills, gently sloping upper pediment, very gently sloping lower pediments and very gently sloping to almost flat valleys. The characteristics of the soils mapped under this landscape are as follows.

Unnala-Sivasandra-Matha Association

Soils of this association occur on undulating topography on summits and hillslopes with slope gradients ranging from 5-15% and are susceptible to erosion. Unnala series are shallow to moderately deep, yellowish red to red, gravelly soils with 50% quartz gravels. A compact layer of quartzite with hornblende schists underlies the soils. The available moisture retaining capacity is 2.9 cm in 40 cm depth. Sivasandra soils are shallow to very shallow, dark red, gravelly clay with 10-15% quartz gravel, brown to black iron and manganese concretions. The substratum consists of abundant pisolitic iron and manganese saprolitic material. Manganesetoxicity is expected as seen from the present natural vegetation. Matha soils are moderately deep, yellowish red, gravelly, calcareous soils. Lime concretions and quartz stone with weathered rock pieces are common in subsoil. The available moisture retaining capacity is 3.9 cm in 40 cm depth.

Honnavalli-Virapuram-Unnala Association

Soils of this association occur on undulating hills and foothills with slope gradients ranging from 5-10%. Honnavalli soils are moderately deep, red to dark red, gravelly soils. The available moisture retaining capacity is 5.2 cm in 40 cm depth. The soils seem to support good vegetation though moderately deep. Virapuram soils are shallow to moderately deep, dark red, gravelly soils. They are frequently covered with quartz gavel upto 50-70%. The available moisture capacity is very low and is poor in plant nutrients. Unnala soils are shallow to moderately deep, yellowish red to red, gravelly soils with 50% quartz gravels.

Virapuram-Doddaguni-Honnavalli Association

Soils of this association occur on gently sloping upper pediments with 5-10% slopes. Virapuram soils are shallow to moderately deep, dark red, gravelly soils with quartz gravel upto 50-70% on the surface. Doddaguni

soils are very deep, dark reddish brown, lateritic, clayey, with rounded iron concretions and an iron concretionary layer below 80-100 cm depth. The available moisture retaining capacity is 15.2 cm in 90 cm depth. These soils are susceptible to erosion and harden when dried. Honnavalli soils are moderately deep, red to dark red, gravelly soils. The surface is generally covered with gravel.

Doddaguni-Virapuram Association

Soils of this association occur on gently sloping upper pediments with 5-10% slope. Doddaguni soils are very deep, dark red, lateritic, clayey with rounded iron concretions and an iron concretionary layer below 80-100 cm depth. Virapuram soils are shallow to moderately deep, dark red, gravelly soils, with quartz gravel (50-70%) on the surface.

Doddaguni-Kadabagere Association

Soils of this association occur on very gently sloping lower pediments with 3-5% slope. Doddaguni soils are very deep, dark reddish brown, lateritic, clayey soils. Kadabagere soils are very deep, dark red, clayey and have few soft iron concretions in lower depths. The available moisture retaining capacity is 14.5 cm in 90 cm depth.

Kodigehalli-Doddaguni Association

Soils of this association occur on very gently sloping lower pediments with 1-5% slope. Kodigehalli soils are very deep, dark brown, clayey, calcareous soils. The subsoil has slickensides and shiny pressure faces. They crack during dry season and are moderately susceptible to erosion. The available moisture retaining capacity is 17.5 to 18 cm in 90 cm depth. They remain moist in the control section for longer times. They can sustain standing crops during dry spells. Doddaguni soils are very deep, dark reddish brown, lateritic, clayey soils.

Sira-Kodigehalli Association

Soils of this association occur on very gently sloping lower pediments with slopes from 3-5%. Sira soils are shallow to moderately deep, very dark grey brown, clayey, calcareous soils eroded in patches, lime concretions are common in subsoil. The available moisture retaining capacity is 5.1 cm in 35 cm depth. They are dry in most part of the control section during the year. Kodigehalli soils are very deep, dark brown to very dark brown, clayey, calcareous soils with strongly developed structure in the subsoil.

Kanatur-Hamplapura-Nittur Association

Soils of this association occur on flat to very gently sloping low lands with slope gradients less than 1%. Kanatur soils are very deep, yellowish brown to pale brown. calcareous, clayey soils. The available moisture retaining capacity is 12 cm in 90 cm depth. Brown mottles are frequently observed in the subsoil along with lime concretions. Hamplapura soils are very deep, brown to light olive brown, clayey mottled 'soils which have very slow permeability and impeded drainage. There for more than 200 days in a year. Nittur soils are very deep, very dark grayish brown to very dark grey, clayey calcareous soils with a high water table and moist subsoil for a long time.

Hamplapura-Kanatur Association

Soils of this association occur in almost flat to very gently sloping valleys with slopes ranging from 0-1%. Hamplapura soils are very deep, brown to light olive brown, clayey, mottled soils. Kanatur soils are very deep, yellowish brown to pale brown, calcareous, clayey soils.

4.4 Soil Classification

Soils of Tumkur district have been classified according to the USDA system of soil classification. They are classified under 3 Orders, 5 Suborders, 7 Great groups, 13 Subgroups, 25 Families and 37 Series. The classification details are given in Table 6. Alfisols cover about 49 per cent area followed by Inceptisols (about 28 per cent) and Entisols cover about 19 per cent area.

Soils of Tumkur district has been classified using the traditional system for local use of the soil map (Table 6a). Red clayey soils occupy about 43 per cent of the area in the central and southern part of the district. Red gravelly loam soils cover about 20 per cent of the area in the Northern part of the district.

Table 6. Soil classification —Tumkur Dsitrict, Karnataka

Order	Sub order	Great group	Subgroup	Family	Series
ALFISOL 517875 ha 48.6%	USTALF	PALEUSTALF	Oxic	Clayey-skeletal	Dyavapatna
		RHODUSTALF	Oxic	Fine	Bidare Kadabagere
			Typic	Fine	Doddaguni
				Clayey-skeletal	Arasikere
				Loamy-skeletal	Shettikere
		HAPLUSTALF	Typic	Fine	Brahmanapalle, Gubbi
				Clayey-skeletal	Ankalakoppa
				Loamy-skeletal	Kottacheruvu
ENTLSOL 202287 ha 19.0%	ORTHENT	USTORTHENT	Lithic	Clayey (calcareous)	Sira
				Loamy-skeletal	Kuruganahalli Sivasandra
			Aquic	Fine loamy	Kanatur
			Typic	Fine	Kumudvati Hamplapura
				Fine (calcareous)	Nittur
				Fine loamy (calcareous)	Matha
	AQUENT	HAPLAQUENT	Typic	Fine loamy (calcareous)	Peddamanaturu
	FLUVENT	USTIFLUVENT	Aquic	Fine	Chennakesavapura
			Typic	Fine (calcareous)	Karidasanahalli Roppam
				Fine loamy	Jayamangli Shimsha
				Coarse loamy	Pennar
INCEPTISOL 296567 ha 27.8%	USTEPT	HAPLUSTEPT	Lithic	Clayey	Bugadur
				Clayey-skeletal	Unnala
			Typic	Fine	Madihalli Oblapura Lakkanpalya
				Fine (calcareous)	Kodigehalli
				Loamy-skeletal	Madakasira Vallur Kadamalkunte
				Clayey-skeletal	Hospura Honnavalli Virapuram

Note: 1. Families of dominant soils are taken for classification
2. All families are mixed mineralogy class

The thematic maps of the district on slope, soil depth, surface drainage, erosion, surface texture, particle size class, surface stoniness and soil reaction (pH) are shown in figure 10-17, respectively.

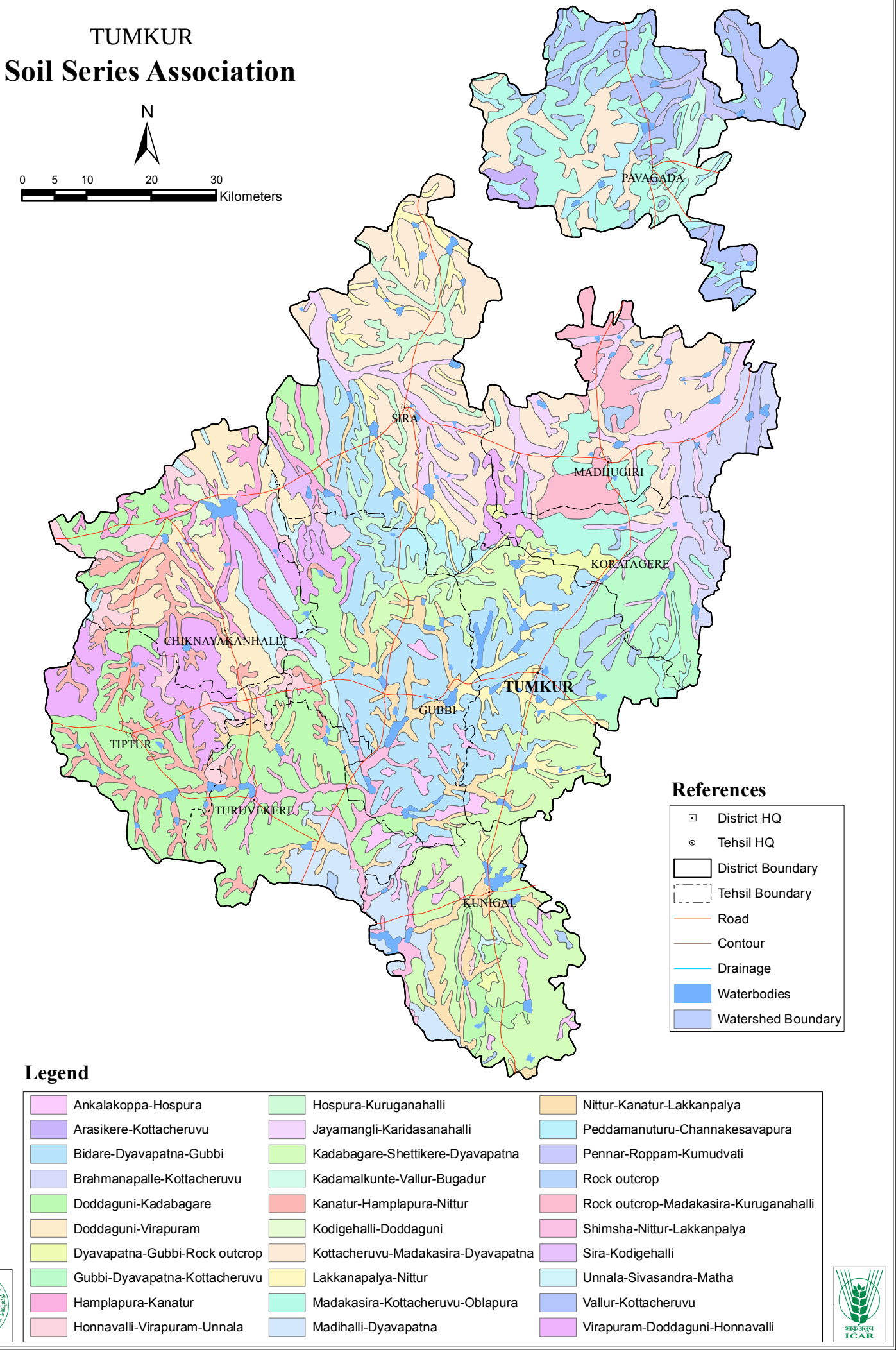
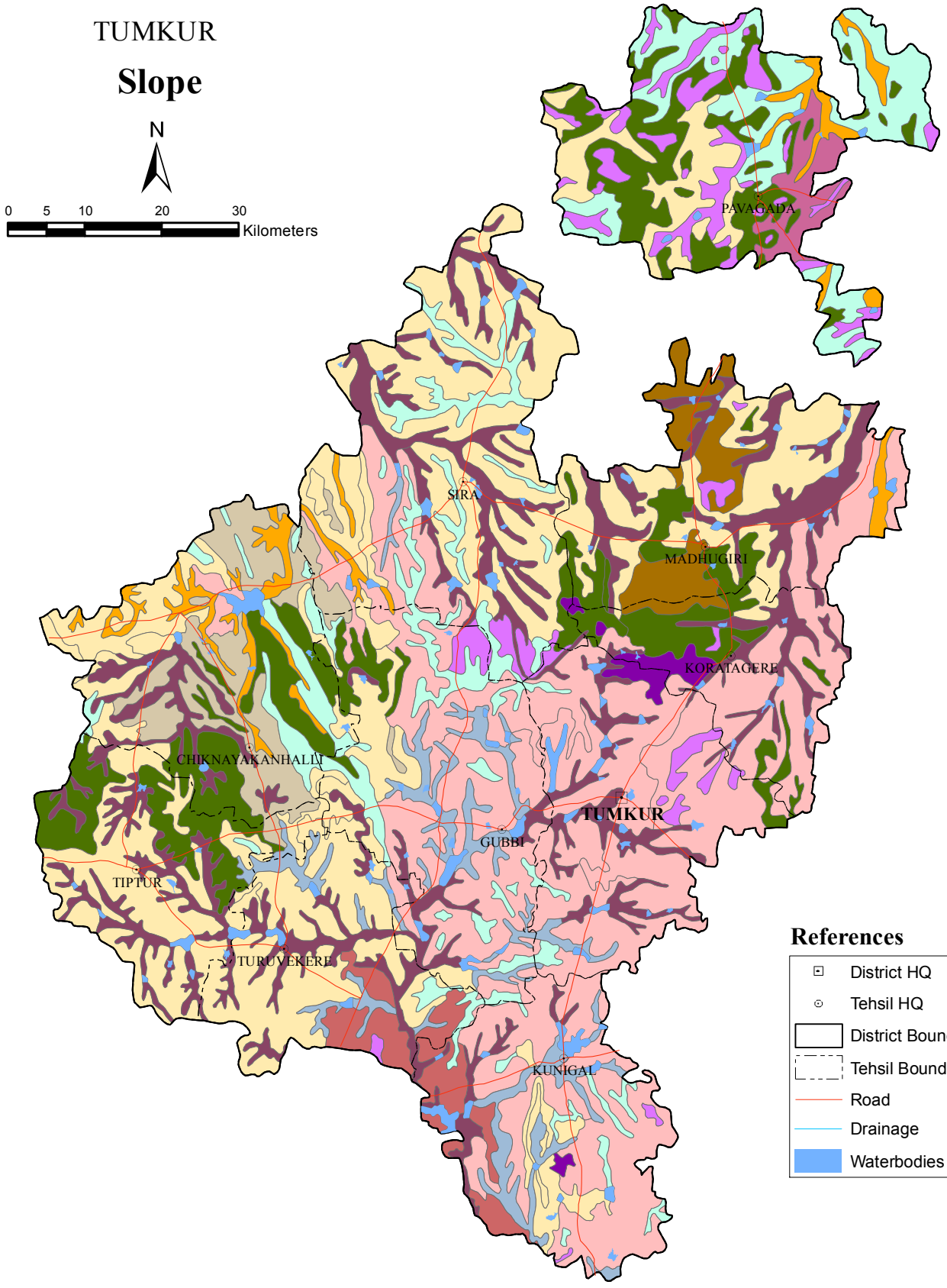


Fig. 9: Soil Series Association



Legend

- Level to nearly level
- Level to nearly level-Very gently sloping
- Very gently sloping
- Very gently sloping-Level to nearly level
- Very gently sloping-Gently sloping
- Very gently sloping-Gently sloping-Moderately sloping
- Very gently sloping-Moderately sloping
- Very gently sloping-Moderately sloping-Gently sloping
- Gently sloping-Very gently sloping-Moderately sloping
- Gently sloping-Moderately sloping-Very gently sloping
- Gently sloping-Moderately sloping-Very gently sloping-Rock outcrop
- Gently sloping-Moderately sloping
- Rock outcrop-Gently sloping-Very gently sloping-Moderately sloping

Fig: 10 Slope

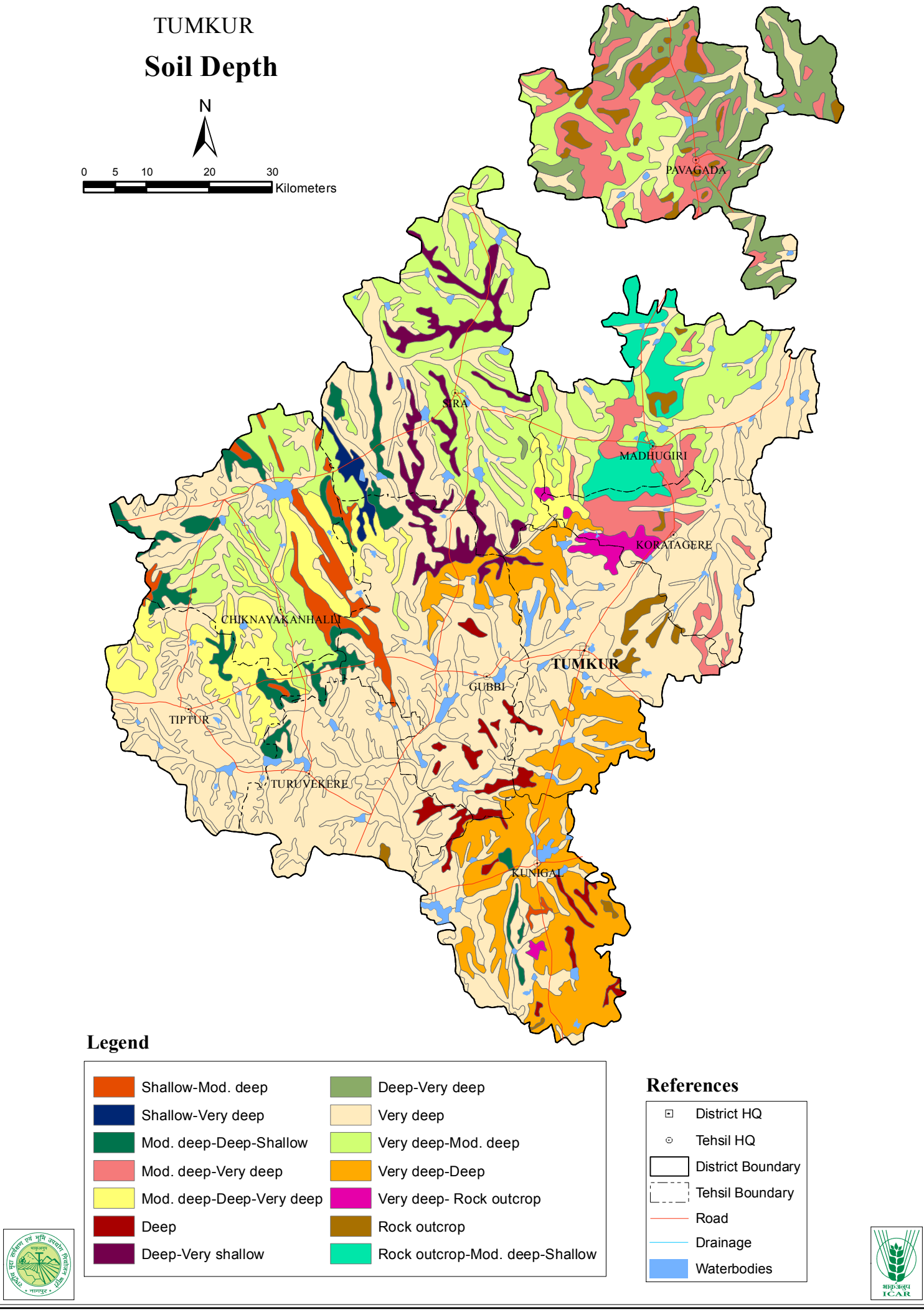


Fig: 11 Soil Depth

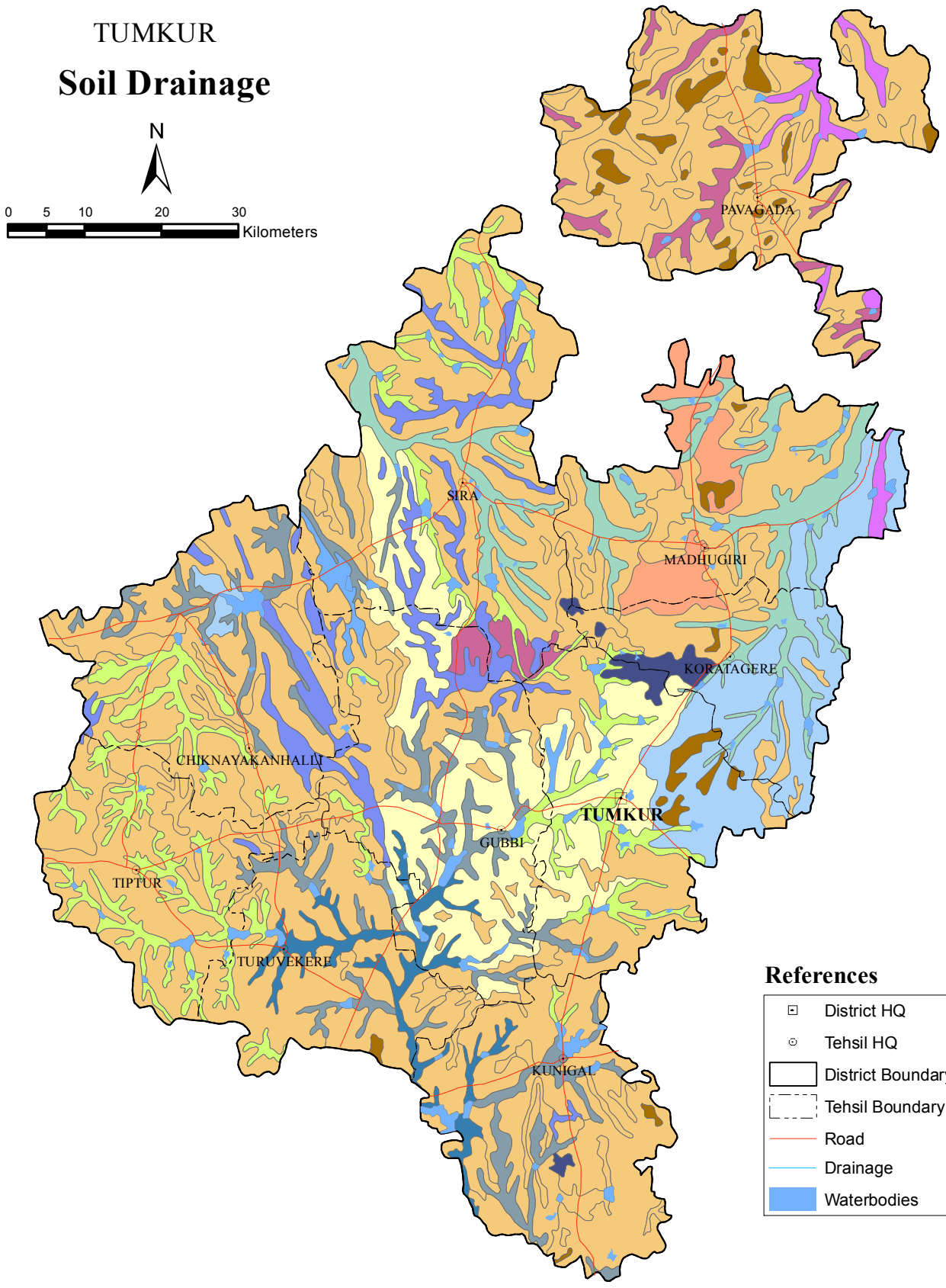


Fig: 12 Soil Drainage

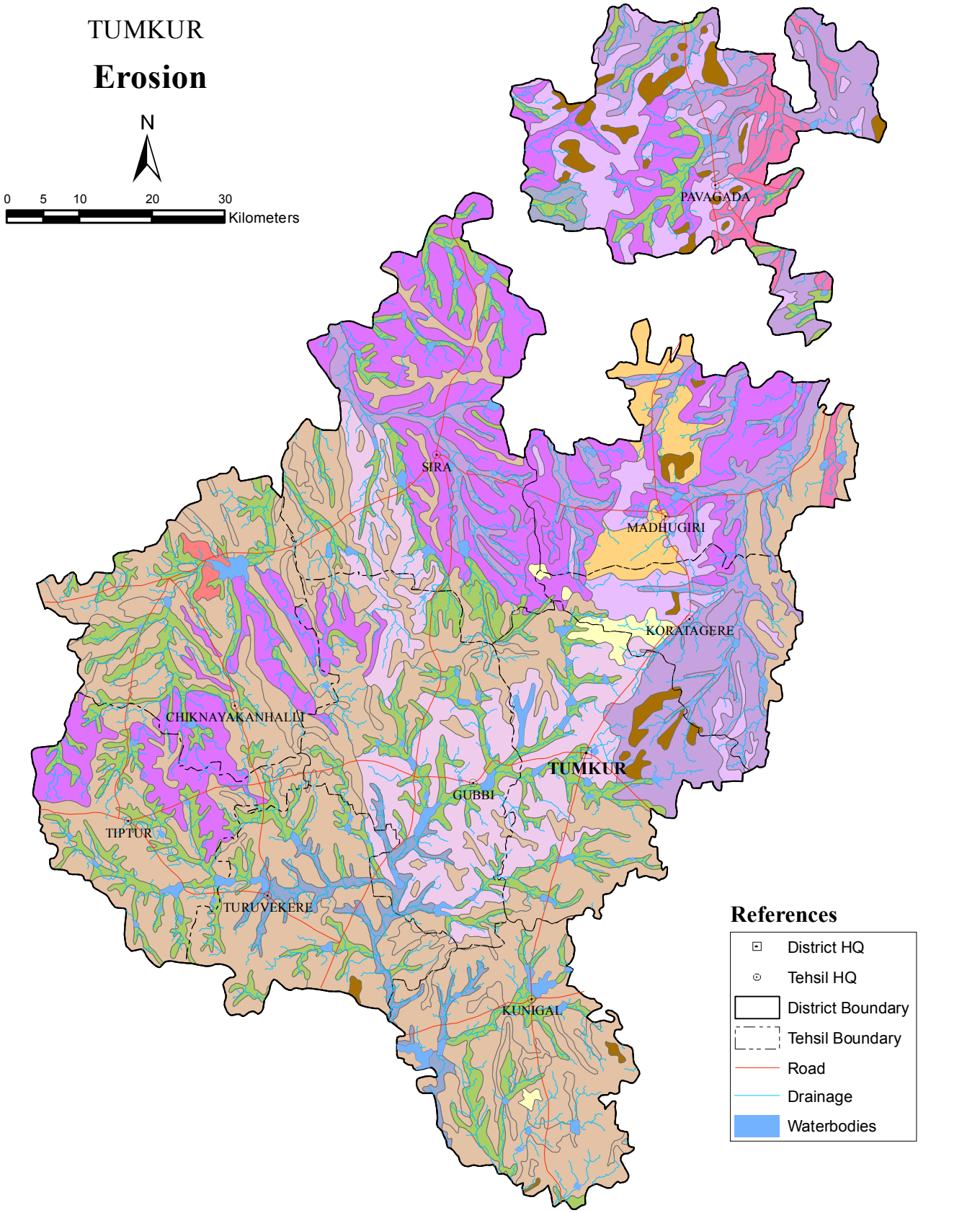


Fig: 13 Erosion

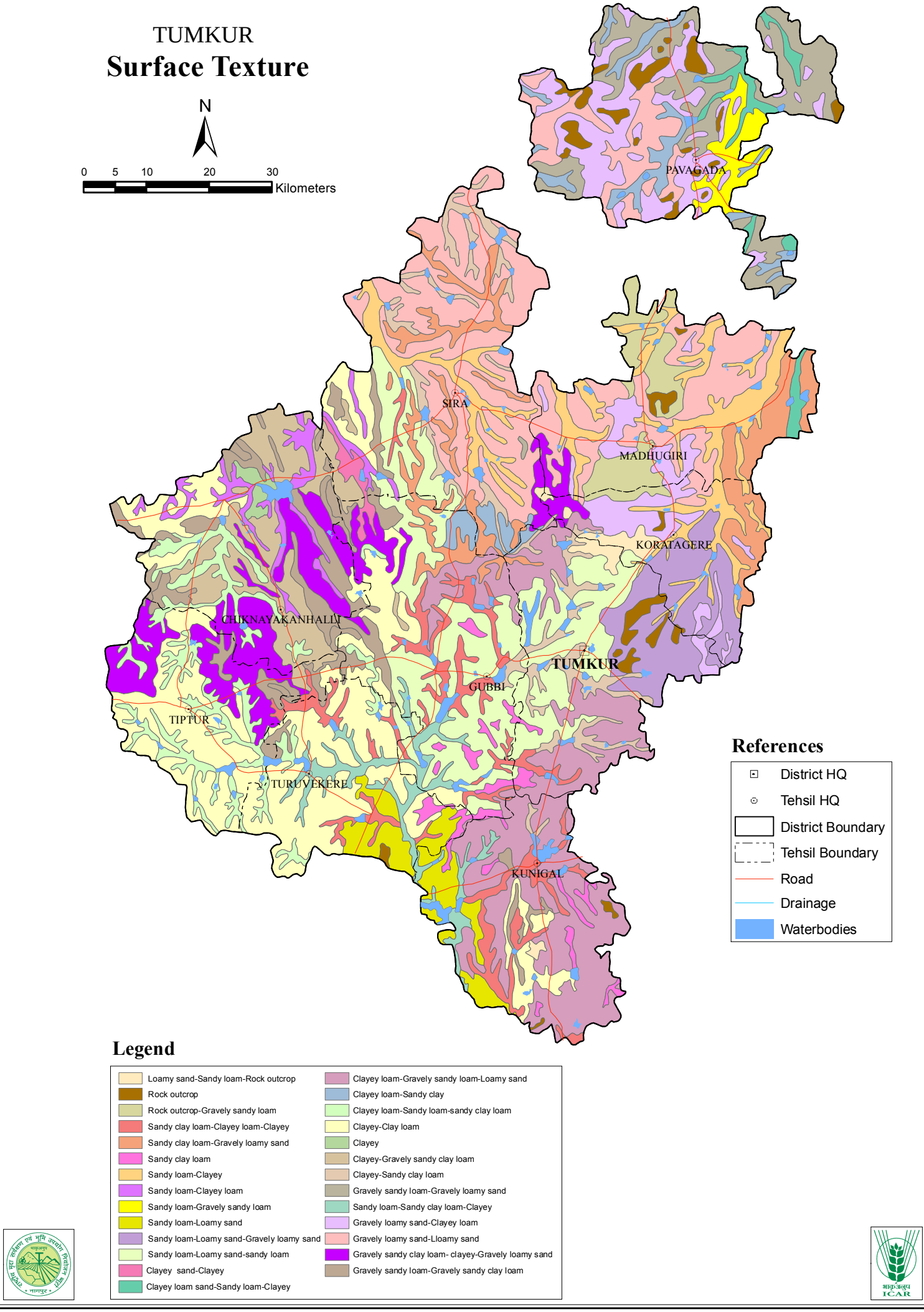


Fig. 14: Surface Texture

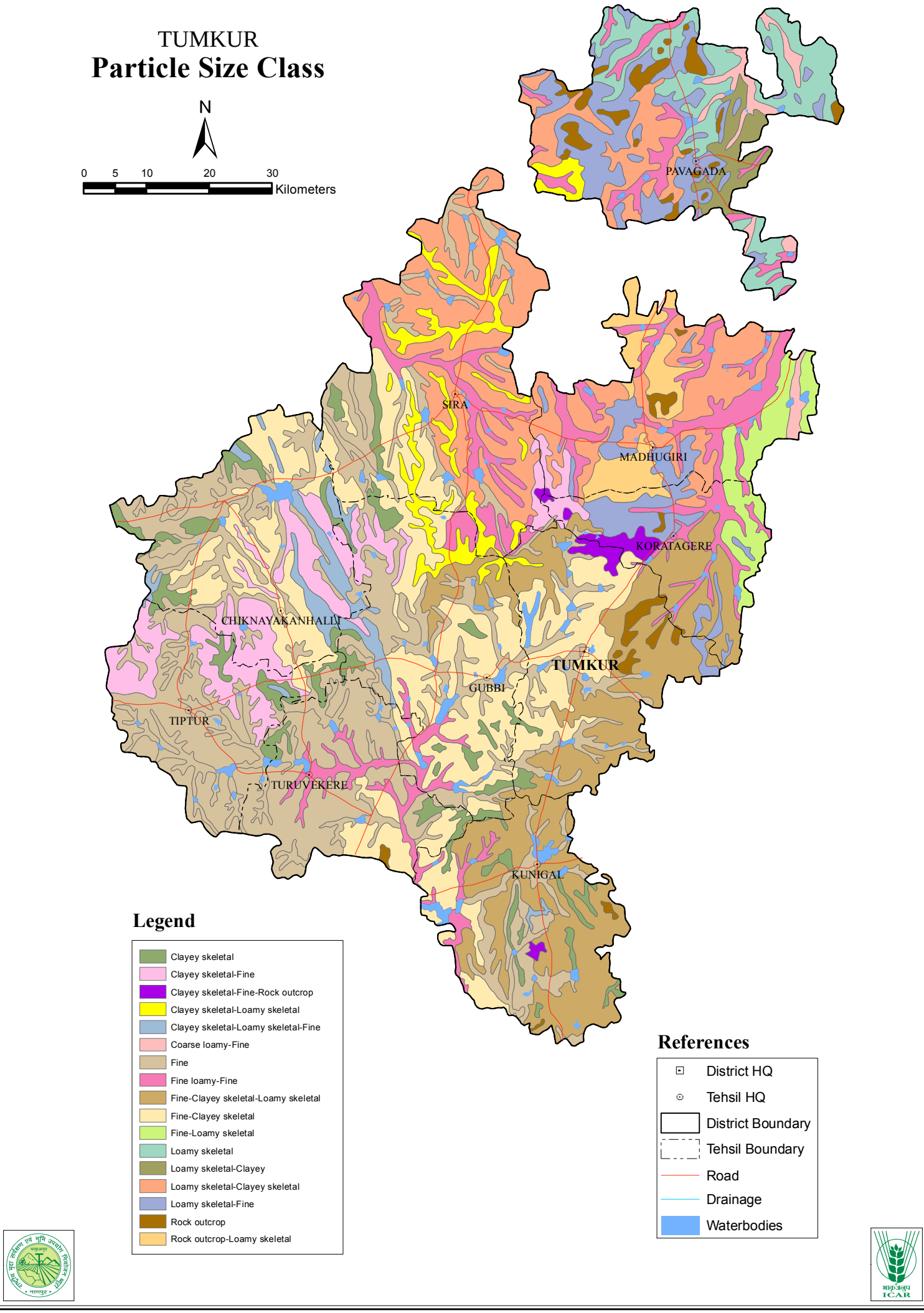


Fig. 15: Particle Size Class

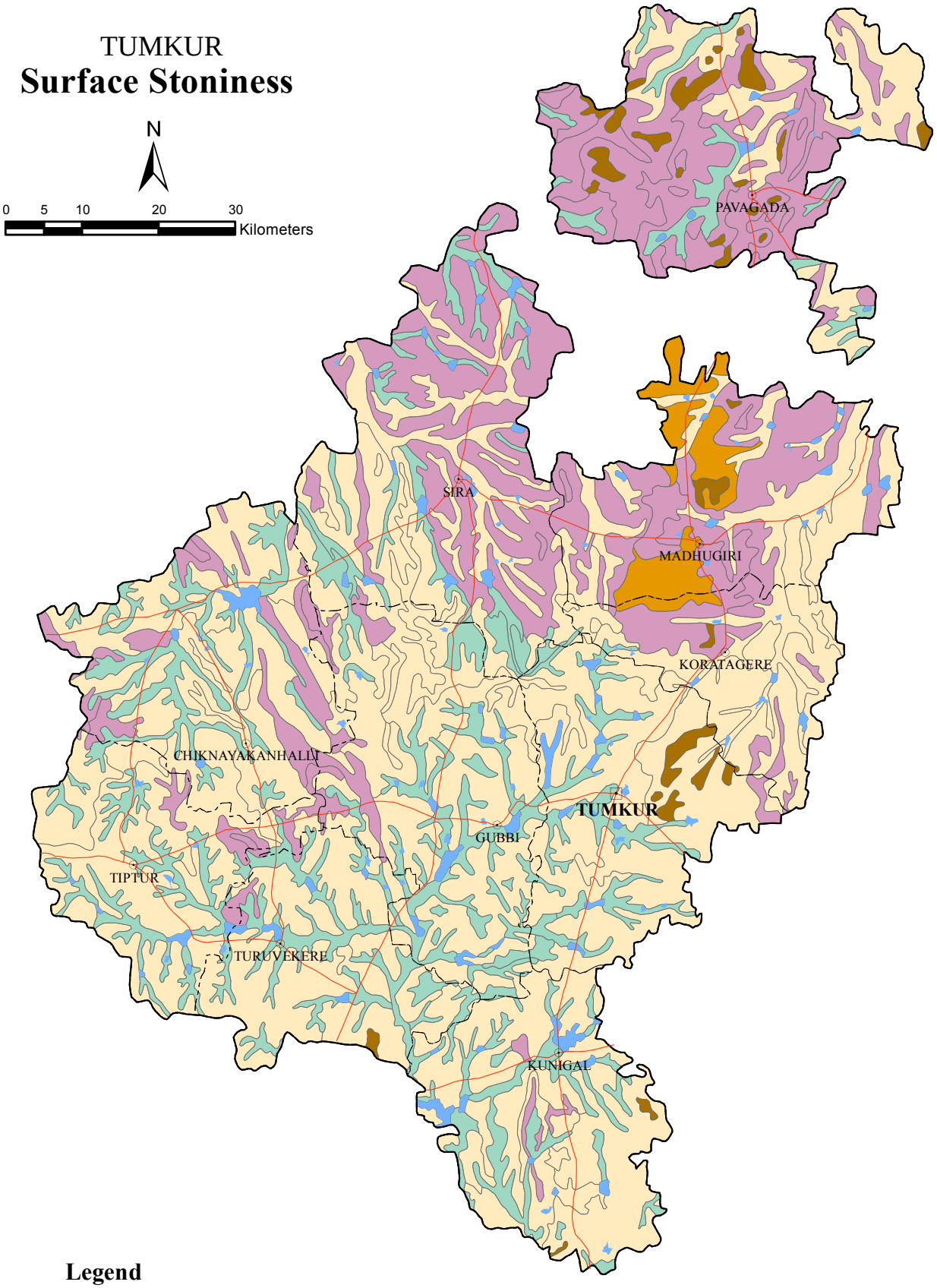


Fig. 16: Surface Stoniness

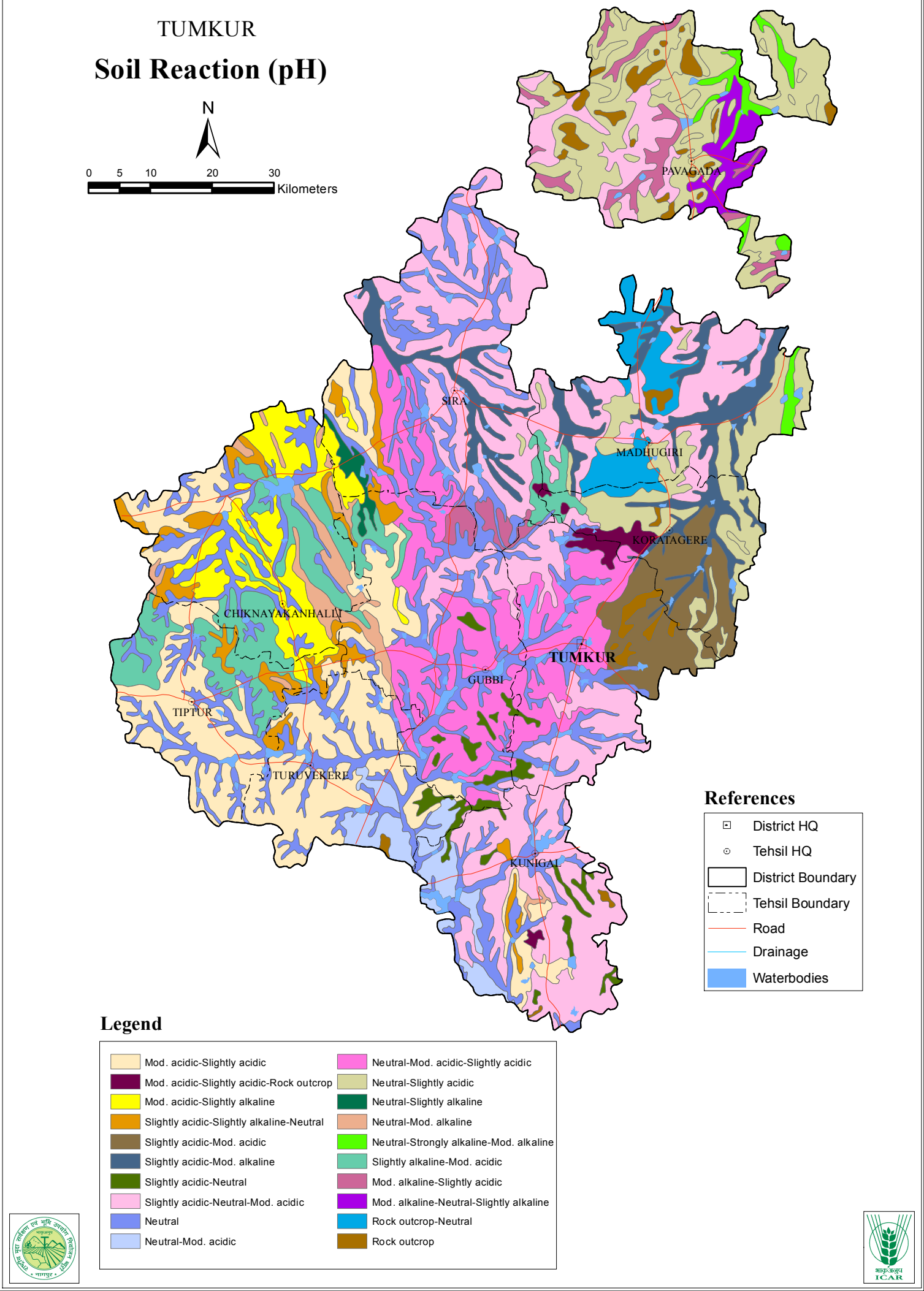


Fig: 17 Soil Reaction (pH)

Table 6a. Soil family grouping of soils - Tumkur District, Karnataka

Map symbol	Soil family	Soil map unit	Area	
			ha	%
1	Rock land	1, 2	48026	4.6
2	Clayey-skeletal Oxic Plaeustalf	3	4712	2.3
3	Fine Oxic Rhodustalf	17, 18	181746	17.1
4	Fine Typic Rhodustalf	25, 26	144468	13.6
5	Clayev-skeletal Typic Rhodustalf	10	442	0.4
6	Fine Typic Haplustalf	6, 8	43245	4.1
7	Clayev-skeletal Typic Haplustalf	16	14224	1.3
8	Loamy-skeletal Typic Haplustalf	7	105238	9.9
9	Fine (calcareous) Lithic Ustorthent	28	3517	0.3
10	Fine Loamy Aquic Ustorthent	29	54319	5.1
11	Fine (calcareous) Typic Ustorthent	20	37710	3.5
12	Fine Typic Ustorthent	30	17071	1.6
13	Fine loamy (calcareous) Typic Haplaquent	12	18466	1.7
14	Fine loamy Typic Ustifluvent	13, 21	66140	6.2
15	Coarse loamy Typic Ustifluvent	14	5064	0.5
16	Clayey-skeletal Lithic Haplustept	22	15776	1.5
17	Fine Typic Haplustept	11,19	64250	6.0
18	Fine (calcareous) Typic Haplustept	27	2276	0.2
19	Loamy-skeletal Typic Haplustept	4, 5, 9	111950	10.5
20	Clayey-skeletal Typic Haplustept	15, 23, 24	102315	9.7

Note: 1. Families of dominant soils are taken for classification

2. All families are mixed mineralogy class

Table 6b. Soil subgroups - Tumkur District, Karnataka

Map symbol	Sub group	Soil map units	Area	
			ha	%
1	Oxic Paleustalf	3	4712	2.3
2	Oxic Rhodustalf	17,18	181746	17.1%
3	Typic Rhodustalf	10, 25, 26	148710	14.0
4	Typic Haplustalf	6, 7, 8, 16, 17	162707	15.3
5	Lithic Ustorthent	28	3517	0.3
6	Aquic Ustorthent	29	54319	5.1
7	Typic Ustorthent	20,30	54781	5.1
8	Typic Haplaquent	12	18466	1.7
9	Typic Ustifluvent	13,14,21	71204	6.7
10	Lithic Haplustept	22	15776	1.5
11	Typic Haplustept	4, 5, 9, 11, 15,19, 23, 24, 27	280791	26.4
12	Rock land	1, 2	48026	4.6

Note: Soil subgroups of dominant soil are considered

Soil taxonomy map of the district is shown in figure 18.

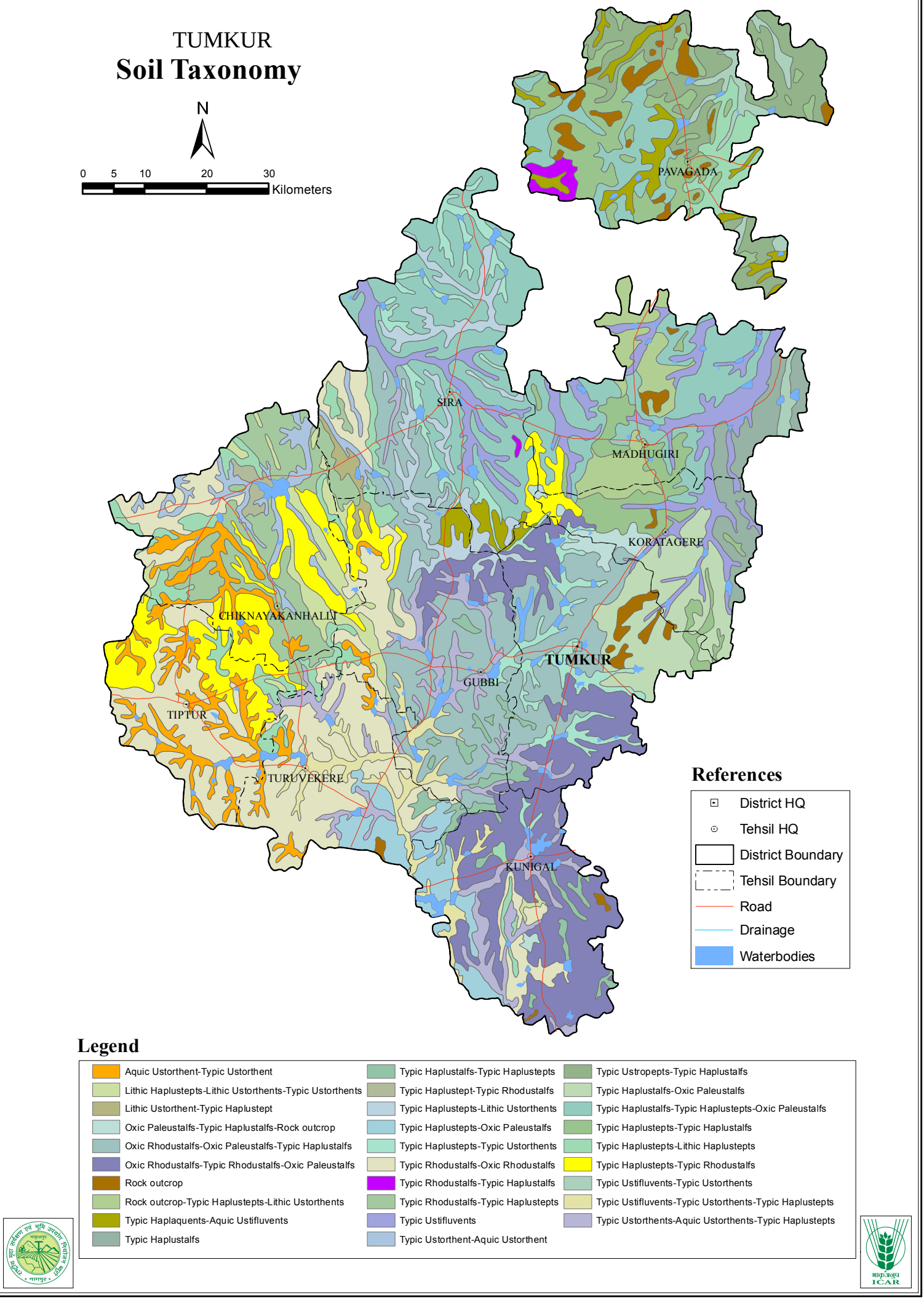


Fig. 18: Soil Taxonomy

5.

SOIL SURVEY INTERPRETATIONS FOR LAND USE PLANNING

The soil map which is the product of soil survey, it provides scientific information on soils, which can be used, for proper management of soils for reference. In view of the need for proper use of the soils of Tumkur district, land capability, land irrigability, productive and problem soils, suggested land use and soil suitability for crops have been worked out for the different soil mapping units.

5.1 Land capability classification

Land capability classification evaluates the soils on the basis of their susceptibility to erosion, depth limitations, drainage problems, slope and other characteristics. Groupings are made into 8 classes (I-VIII), based on the limitations. Cultivable soils are grouped under classes I to IV. The soils not suitable for cultivation are recommended for forestry, recreation purposes etc. and are grouped under Classes V-VIII (Fig.19).

Subclasses are based on limiting factor 's' for soils, 'e' for erosion, 'w' for wetness, and 'c' for climate, and indicated by suffixes to the designations of the classes. The soil mapping units have been grouped into different land capability subclasses as given in Table 7.

Considering the above criteria, the soil units of the district have been grouped into 19 different land capability subclass associations. In the district, 71.5% of the area is suitable for agriculture of this about 22.5% being good cultivable lands (IIs) and 49.0% moderately good and fairly well lands (IIe, IIIs, IIIes IVe). About 20.1% is not suitable for agriculture, being suitable for forestry, pasture, silvipastoral systems and 8.4% suitable for quarrying etc.

A brief description of the land capability subclasses is given in table 7 along with a summary grouping of the same in table 8. The land capability map is appended.

5.2 Land irrigability classification

The district has limited area under irrigation mostly in the plains and valleys. The behaviour of soils under irrigation can be predicted from soil survey data. Possible problems are assessed and developmental measures are formulated. Water if judiciously used can give proper benefits. If not, it brings problems of water logging and salinity. Soil characteristics like texture, depth, available moisture retention capacity, permeability, salt and alkali conditions are considered while grouping for soil irrigability classes. Land irrigability classification is made taking into consideration, in addition to the soil irrigability class, the quantity and quality of water, drainage requirements, and topographic and socio-economic considerations.

Land-irrigability classification is a grouping of soil mapping units based on the degree of limitations of soils for sustained use under irrigation and also on physical and socio-economic factors. Lands suitable for irrigation are grouped under classes 1 to 4 according to their limitations. Lands not suitable for irrigation are grouped under classes 5 and 6 (Fig.20).

The land-irrigability classes have subclasses to indicate the dominant limitations for irrigation purposes. Thee subclasses based on limitations are recognized and denoted by "e for soil limitations such as heavy clay or sandy texture, soil depth, "t" for topography limitation like steep slopes and "d" for drainage limitation like water logging, high ground water table.

Following the above criteria, the soil units of the district have been grouped into 18 different irrigability subclasses. In the district about 14% are good irrigable lands, 30% moderately irrigable lands, 21% marginal irrigable lands, 22% of the lands are marginal for irrigation and 12 % and not suitable for sustained irrigation.

The irrigability classes of the different mapping units is given in Table 9 along with a summary grouping of the same presented in table 10. Irrigability map prepared is appended.

Table 7. Land capability classification for soils of Tumkur District, Karnataka

Map symbol	Land capability sub class	Description	Soil map unit	Area ha	Percent
1	IIs	Good lands with root zone limitation	11, 12, 13, 14, 20, 21, 29, 30	239293	22.5
2	IIe-IIIes	Good lands with problem of erosion and moderately good lands with soil and erosion hazard	6, 18	103079	9.7
3	IIe-IVes	Good lands with problem of erosion and marginal lands with soil erosion limitation	8	20848	2.0
4	IIIs	Moderately good lands with root zone limitation	9	15933	1.5
5	IIIs-IIIes	Moderately good lands with soil limitation and erosion hazard.	5	39300	3.7
6	IIIe-IIe	Moderately good lands and good lands with problems of erosion.	26, 27, 28	104324	9.7
7	IIIe-IIIes-IIe	Moderately good lands with erosion hazard and soil limitation, good lands with problems of erosion.	17	101064	9.5
8	IIIe-IIIes	Moderately good lands with erosion hazard and soil limitation.	19,25	69644	6.6
9	IIIes-IIIe-IVes	Moderately good land and marginal lands with erosion and soil limitations	24	55816	5.2
10	IIIs_IVs	Moderately good lands with marginal lands with root zone limitation.	16	14224	1.3
11	IIIes-IVes	Moderately good lands and marginal lands with erosion hazard and soil limitation	7	105238	9.9
12	IIIes-IIe-VIII	Moderately good lands with erosion hazard and soil limitation, good lands with erosion hazard and rock outcrops.	3	24712	2.3
13	IVs-IIIes	Marginal lands with root zone limitation and good lands with erosion hazard and soil limitation	10	4242	0.4
14	IVes-IIIes-IIIs	Marginal lands with erosion hazard and soil limitation, moderately good lands with erosion hazard and soil limitation.	4	56717	5.3
15	IVes-IIIes-VIs	Marginal lands and moderately good lands with erosion hazard and soil limitation and rugged lands with limited soil depth	23	18466	1.7
16	IVs-VIs	Marginal lands with root zone limitation and stony lands with limited soil depth	15	28053	2.6
	Lands suitable for agriculture			**1000953**	**93.9**
17	VIs-IVes	Rugged lands with soil limitation and marginal lands with erosion and soil limitation.	22	15776	1.5
18	VIII-IVes-VIs	Rock outcrops, marginal lands with problems of erosion and soil limitation, stony land with limited depth.	2	25023	2.4
19	VIII	Rock land	1	23003	2.2
	Lands not suitable for agriculture			**63802**	**6.1**

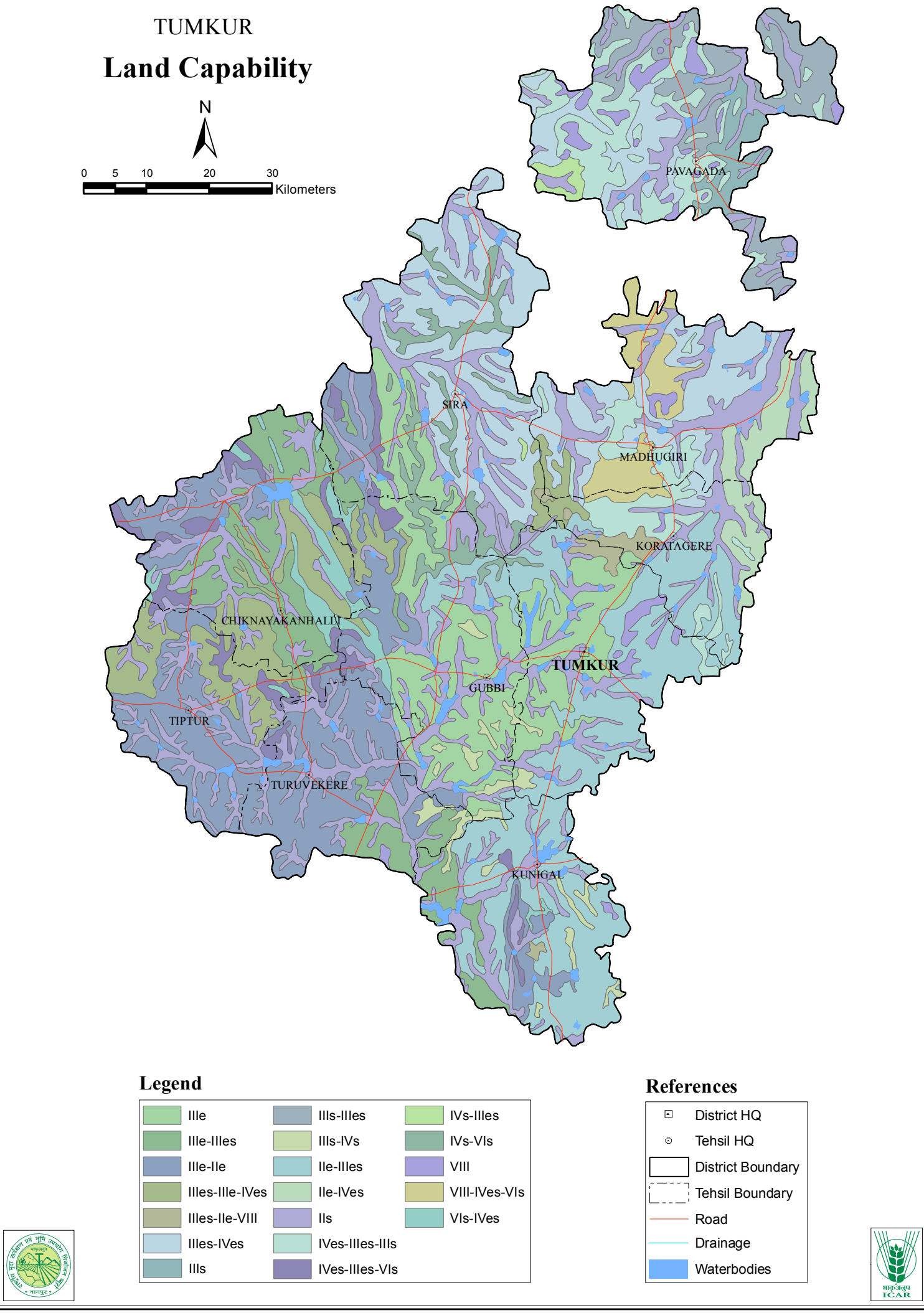


Fig: 19 Land Capability

Table 8. Summary of land capability groupings of Tumkur District, Karnataka

Suitability for agriculture	Soil and land characteristics	Per cent of total area	Suitable for
Good lands (IIs)	Lands under tank irrigation, clayey, fine loamy, very deep paddy soils with minor limitations of texture of sub soil, high fertility.	22.5	Irrigated crops like paddy, Ragi, groundnut, vegetables, coconut, banana
Moderate lands (lle,IIIs Ies, IVe)	Very gently sloping to gently sloping pediments with fine loamy, clayey-skeletal and loamy- skeletal soils, hard compact subsoil, moderate fertility, slight to moderate erosion.	49.0	Ragi with purses, groundnut, redgram, horse gram etc.
Poor lands (IVes and other associations)	Undulating to rolling pediments, coarse loamy and loamy-skeletal soils, hard compact soil, poor fertility, and moderate to severe erosion.	20.1	Horse gram, cowpea, pearl millet, fodder jowar, short duration varieties, forestry, and pasture.
Unsuitable lands (VI, VIII)	Shallow, loamy, coarse loamy, stony and gravelly soils in between rock outcrops. Very shallow rooting depth, very low fertility, and severe erosion.	8.4	Agro-forestry, pasture, quarrying etc.

Table 9. Land irrigability classification for soils of Tumkur District, Karnataka

Map Symbol	Land irrigability sub class	Description	Soil Map Unit	Area ha (%)
1	1-2s	Very good to good irrigable lands with calcareous soil and problem of a alkalinity	13,14,21 24,30	142594 (13.4)
2	2s	Good irrigable lands with calcareous soil and poor drainage	11,12,20	96699 (9.0)
3	2s-3s	Good and moderately good irrigable lands with gravelly and clayey soils	18	80682 (7.6)
4	2s-3s-3st	Good to moderately good irrigable lands with clayey and gravelly soils and steep slopes	6,17	123461 (11.6)
5	2st-3st	Good to moderately good irrigable lands with clayey and gravelly soils and steep slopes	8	20848 (2.0)
6	3st-2s	Moderately good to good irrigable lands with clayey soils on steep slopes	26,27	100817 (9.5)
7	3s-2s-6st	Moderately good to good irrigable lands with soil limitations and non-irrigable lands with rock outcrops	3	4712 (2.3)
8	3s-3st	Moderately good irrigable lands with gravelly soils and steep slopes	5,19	63027 (5.9)
9	3s-4s	Moderately good to marginally good irrigable lands gravelly soils on steep slopes	9	15933(1.5)
10	3st-4st	Moderately good marginally good irrigable lands with gravelly and clayey soils on steep slopes	25,16	60151(5.7)
11	4s-2s	Marginally good to good irrigable lands with shallow depth and clayey soils	28	3517 (0.3)
12	4s-3st	Marginally and moderately good irrigable lands with gravelly to stony soils and steep slopes	10	4242 (0.4)
13	4s-3st-3s	Marginally good to moderately good irrigable lands with gravelly soils on steep slopes	4,7	161955 (15.2)
14	4st-3st-4s	Marginally good to moderately good irrigable lands with gravelly and clayey soils on steep slopes	24	55816 (5.2)
15	4s-4st-6st	Marginally good irrigable lands with gravelly soils on steep slopes; non irrigable lands with shallow soils on steep slopes	23	18446 (1.7)

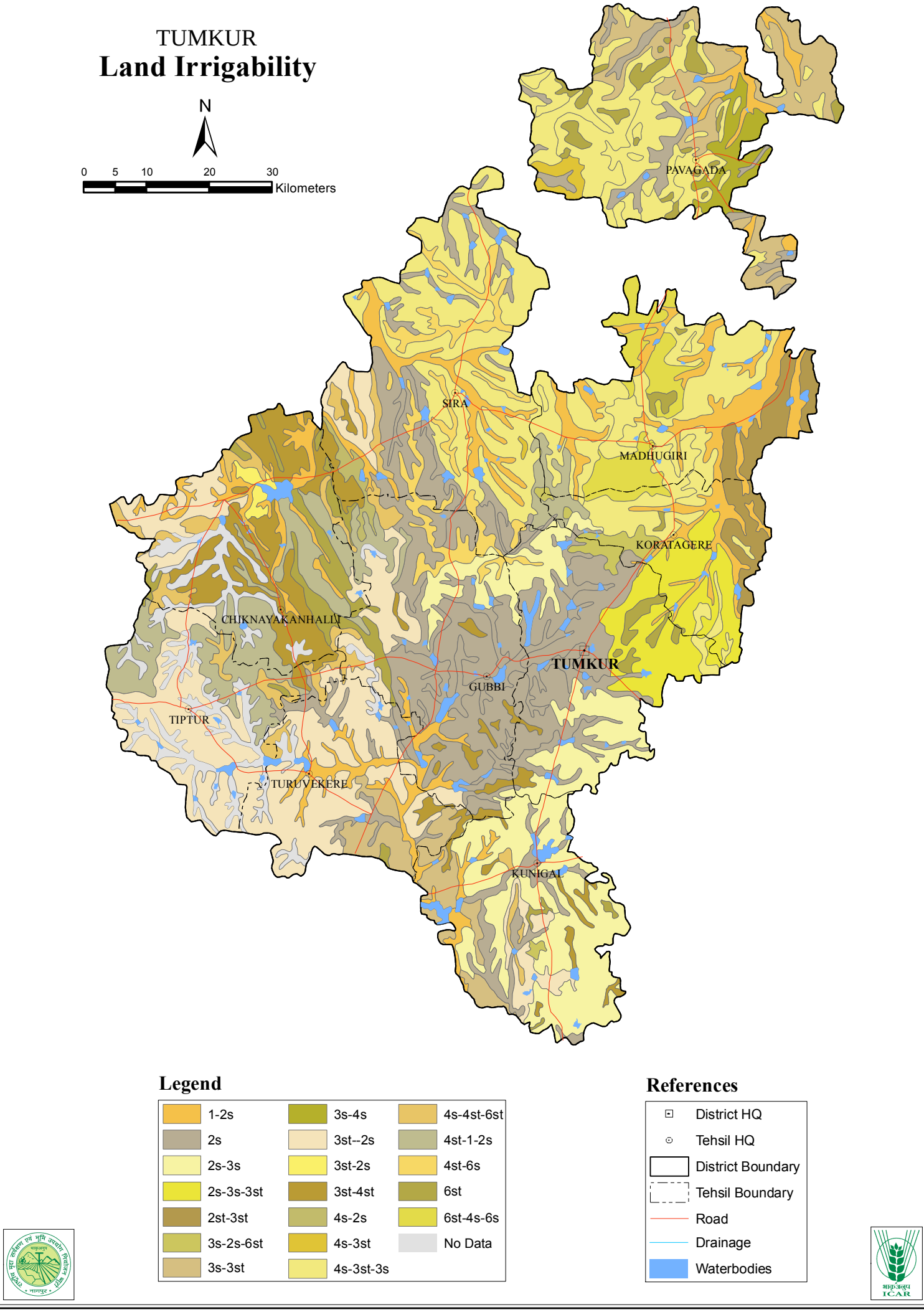


Fig. 20: Land Irrigability

16	4st-6s	Marginally irrigable lands with gravelly soils on steep slopes; non-irrigable lands with shallow soils	15	28053 (2.6)
	Lands suitable for irrigation			**1000953 (93.9)**
17	6st-4s-6s	Non-irrigable lands: rock outcrops and steep slopes, marginally good irrigable lands on steep slopes	2	25023 (2.4)
18	6st	Non-irrigable lands: rock outcrops and rugged lands	1,22	38779 (3.7)
	Lands not suitable for irrigation			**63802 (6.1)**

Table 10. Summary grouping of irrigability classes, Tumkur District, Karnataka

Sl. No.	Category	Description	Percent of total area (Approx.)
1	Good	Good lands which can be used for sustained use under irrigation	14
2	Moderate	Moderate lands with minor limitations for sustained use under irrigation	30
3	Average	Average lands with one or more limitations for sustained use under irrigation	21
4	Marginal	Marginal lands with more than two limitations for sustained use under irrigation and are temporarily not suitable for irrigation	28
5	Not suitable	Lands not suitable for irrigation	6

5.3 Productive soils

The soils of Tumkur district, which have few limitations and are expected to respond well to management for important crops, are classified under productive soils Based on soil characteristics, availability of water, drainage characteristics and slope the soil mapping units have been grouped under two classes good and moderate and the same is presented in table 11 and fig.21. The map of productive soils prepared is appended.

5.4 Problem soils

Soils of the district which have problems associated with rooting depth. gravelliness, stoniness, rockiness, erosion, salinity and alkalinity hazards, relief, moisture retentivity which hinder crop growth and yield are termed problem soils. Based on the intensity of these limitations soil mapping units have been grouped into three class's viz., slight, moderate and severe (Table 12 and Fig.22). The map prepared for problem soils is appended

Table 11. Productive soils, Tumkur District, Karnataka

Map Symbol	Productivity Class	Soil map unit	Description	Recommendation	Area ha (%)
1	Good	11 12 13 14 20 21 29, 30	Very deep, moderately well drained, fine loamy and clayey soils in the valley region under tank irrigation and in stream banks with minor limitations of drainage, calcareousness and alkalinity.	Respond well to management, suitable for paddy, sugarcane, Betelnut, banana, coconut and vegetables. Two crops can be take if irrigation Facilities are available	239293 (22.5)
2	Moderate	6,7 8, 9 17 18 19 27, 28	Very deep, well drained, fine loamy, clayey and clayey skeletal soils with good moisture rententivity on very gently sloping lands. Have limitations like surface crust formation, slight sheet erosion	Respond to light irrigation with proper management practices. Requires minimum soil and water management practices. Suitable for dry land agriculture and long duration crops.	375682 (35.3)

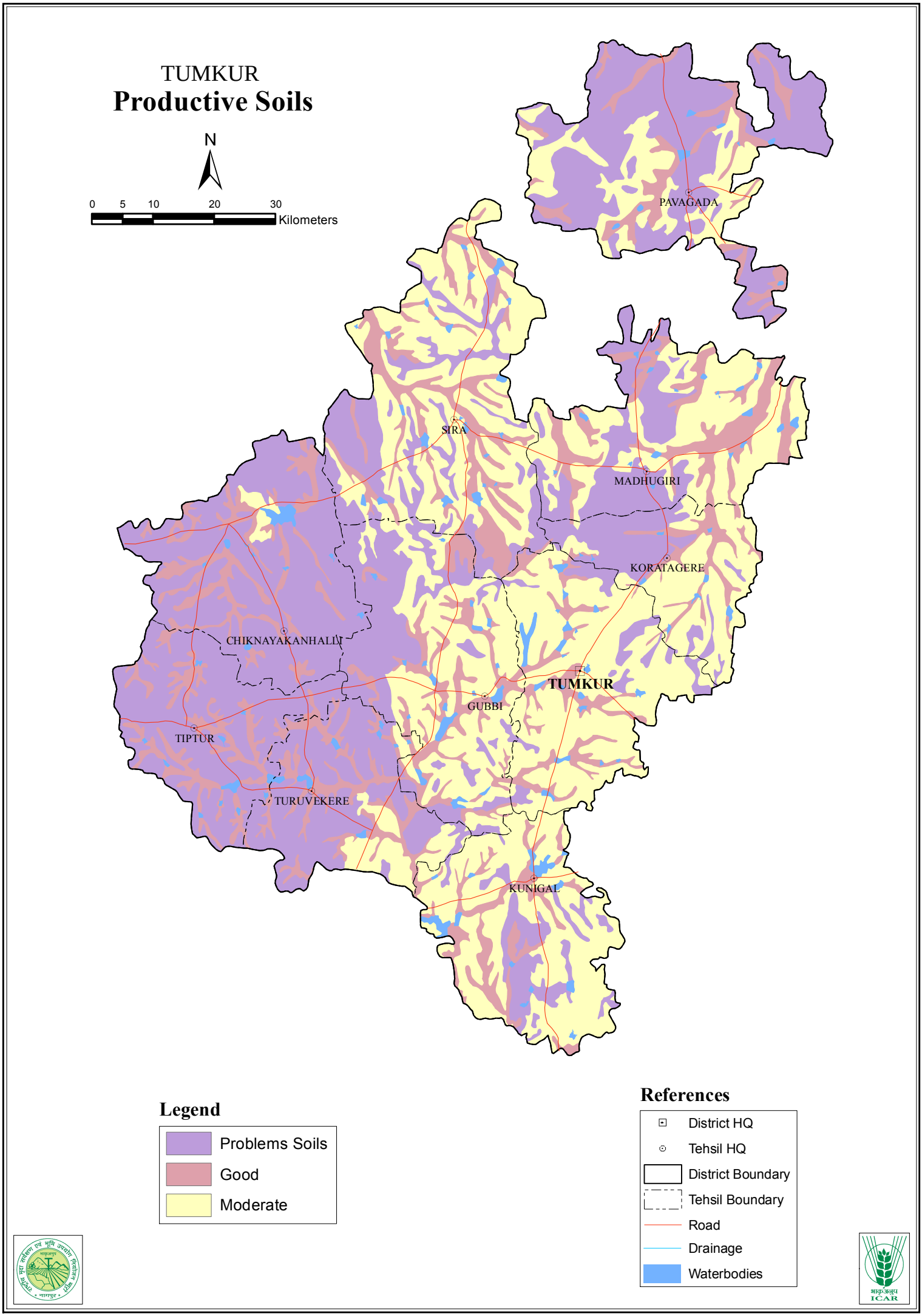


Fig. 21: Productive Soils

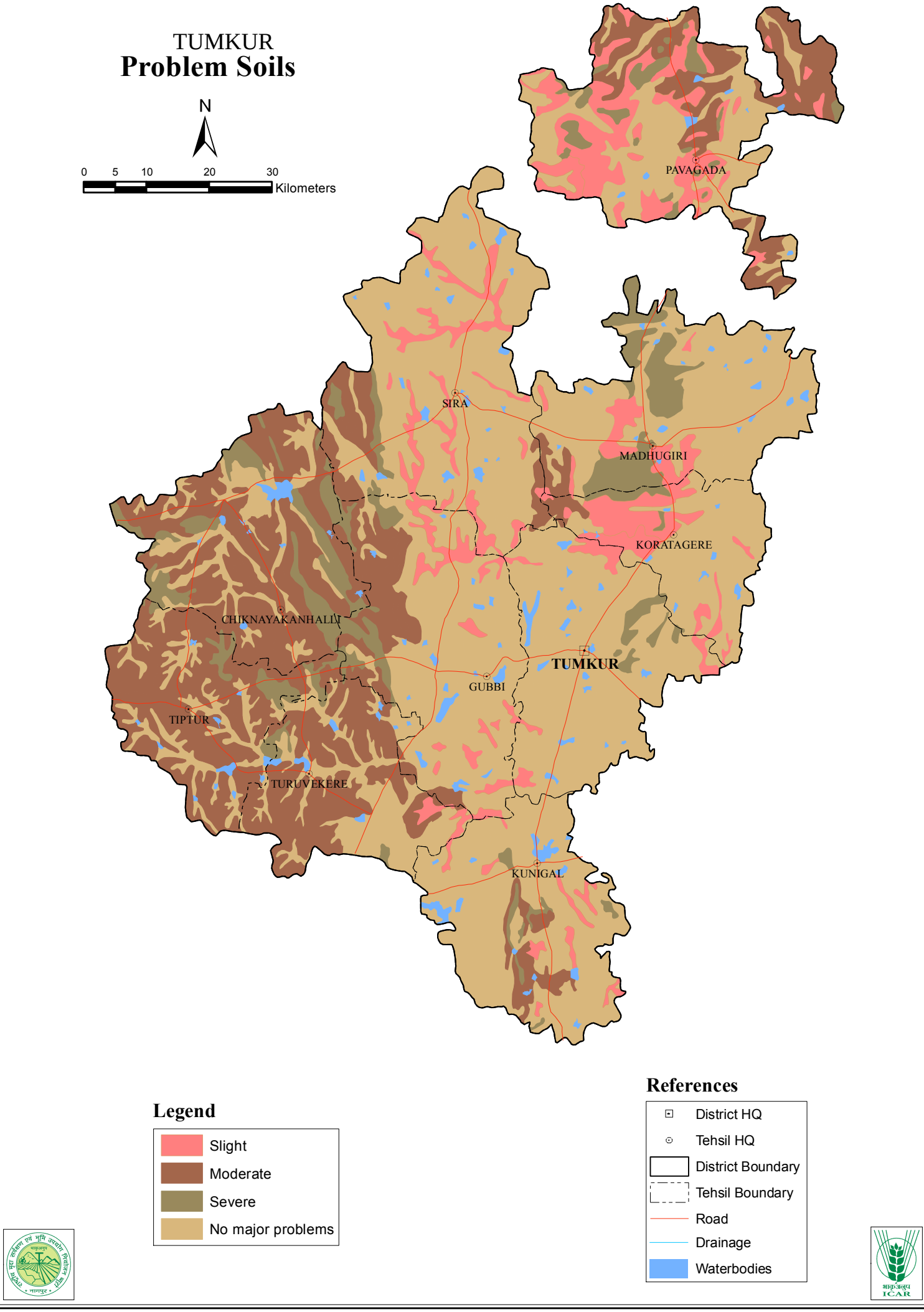


Fig. 22: Problem Soils

Table 12. Problem soils of Tumkur District, Karnataka

Map Symbol	Intensity of problem	Soil mapping Unit	Description	Recommendation	Area ha(%)
1	Slight	3,4,10,15,16	Moderate to deep rooting depth, gravelly, stony, sparse rock, gentle to moderate slopes, moderate runoff, sheet erosion, and medium moisture rententivity, medium to poor nutrient status. Medium to poor vegetation. limited ground water potential	Require soil and water conservation measures; suitable for dryland agriculture wherever possible and grasslands	127948 (12.0)
2	Moderate	5,24,25,26	Shallow to medium rooting depth, highly gravelly, stony, rocky, moderate slopes, sheet, till and gully erosion, moderate to rapid runoff, medium to poor moisture rententivity, poor nutrient status, nil to scanty vegetation and poor ground water potential	Require intensive soil and water conservation measures; suitable for farm forestry, grass lands, limited dry and agriculture	239584 (22.5)
3	Severe	1,2,22,23	Rocky, bouldery, stony hard crust with skeletal soils, strong to moderate slopes, excessive relief and run off	Require permanent vegetative cover; suitable for quarrying; very limited dry land agriculture	82268 (7.7)

5.5 Land suitability for crops

The need for interpretation of soil survey information into land/soil suitability for growing specific crops is in increasing demand so that it can be made use of for better land use in an area.

The soil suitability classification for the major crops of Tumkur district has been attempted based on the parametric approach of FAO (1975) as modified by NBSS & LUP (1987). The soil-site characteristics of the different soils (Table 13) form the basic data for this work. The evaluation has been done using several parameters. Every soil mapping unit was rated as per limitation technique using site characteristics (Table 14). Two limitations indicate that the crop can be grown economically. The degree of limitation allocated for each property in respect of each soil mapping unit is shown in Table 15. The overall suitability of the soils was determined based on the degree and the number of limitations for that particular unit. The final soil suitability was based on the number and degree of limitation (s) according to the following criteria:

Table 13. Soil and site characteristics, Tumkur District, Karnataka

Soil Map Unit	Series Association	Topography (Slope %)	Drainage		Stoniness		Soil Depth (cm)	Texture		pH		Organic matter %	CEC (dsm/kg soil)	Base Saturation %	Remarks
			Ground water table(m)	Class	Surface	Sub soil		Surface	Soil control section	Surface	Soil control section				
1	Rock outcrops	-													
2	Rock out crops	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Madakasira	5-10	10	D4	St3	St3	68	gls	gcl	7.5	7.0	0.45	-	37.1	
	Kuruganahalli	5-10	12	D5	St4		9	gls	-	6.2	-	0.14	-	-	
3	Dyavaapatna	3-5	15	D4	St0	St4	152	Is	sc	5.5	5.6	0.27	18.8	71.5	
	Gubbi	1-3	10	D3	St0	St3	170	sl	scl	6.1	5.9	0.44	29.5	56.4	
	Rock outcrops	1-3	10	D3	St0	St3	170	sl	scl	6.1	5.9	0.44	29.5	56.4	
4	Madakasira	5-10	10	D4	St3	St3	68	gls	gcl	7.5	7.0	0.45	-	37.1	
	Kottacheruvu	3-5	20	D4	St0	St3	115	cl	-	6.5	6.2	0/36	58.9	76.5	
	Oblapura	3-5	10	D4	St0	St3	115	cl	scl	6.5	7.0	1.38	-	-	
5	Vallur	2-3	20	D4	St1	St3	88	gsl	scl	7.2	7.3	0.44	54.2	90.9	
	Kottacheruvu	3-5	20	D4	St0	St3	115	cl		6.5	6.2	0/36	58.9	76.5	
6	Gubbi	See unit 3													
	Dyavapatna	See unit 3													
	Kottacheruvu	See unit 4													
7	Kottacheruvu	See unit 4													
	Madakasira	See unit 2													
	Dyavapatna	See unit 3													
8	Brahamanapalle	3-5	12	D3	Sto	Sto	150	scl	c	6-7	6.3	0/42	25.2	86.1	
	Kottacheruvu	See Unit 4													
9	Kadamalakumte	2-3	II	D4	St3	St4	80	csl	-	7.5	7.6	0.16	58.1	98.8	
	Vallur	See Unit 5													
10	Arasikere	2-3	8	D4	St3	St3	85	gsl	c	6.6	5.9	0.73	63.2	89.6	
	Kottacheruvu	See Unit 4													
11	Lakkanpalya	1-2	1	D2	St1	St0	70	c	c	7.0	7.3	0/8	41.9	84.4	
	Nittur	0-2	3	D2	St1	St1	160	Scl	c	7.2	7.9	0.6	-	86.2	
12	Paddamamuturu	0-1	I	DI	St1	St3	64	cl	gl	8.7	8.5	1.39		90.9	
	Channakeshavapu	1-2	2	Dl	St0	St0	145	se	c	6.3	7.0	1.01	43.1	35.2	
13	Jayamangali	1-2	5	01	St0	St0	120	sl	sld	6.5	6.5	0.3	47.8	75.9	
	Karidasanahalli	1-2	5	02	St0	St0	140	c	cl	8.4	8.1	0.4	46.4	96.1	
14	Pennar	1-2	3	05	Ste	St0	156	ls	sl	6.6	6.9	-	-	-	
	Roppam	1-2	3	04	St1	St1	80	sl	gl	8.6	8.4	0.7	69.3	94.8	
	Kumudvati	1-2	7	02	St0	St0	150	c	cl	7.4	7.5	0.4	70.1	82.9	
15	Hospura	3-10	25	04	St0	St3	86	scl	gsc	6.6sd	6.5	0.7	48.4	39.3	
	Kuruganahalli	See Unit 2													
16	Ankalakoppa	2-10	12	04	St1	St3	62	scl	gsc	5.6	5.7	0.8	40/2	91.2	
	Hospura	See Unit 15													

17	Bidare	1-3	19	03	St0	St3	164	sl	gsc	6.6	6.4	0.4	31.5	76.8	
	Dyavapatna	See unit 3													
	Gubbi	See unit 3													
18	Kadabagere	2-5	17	04	St0	St0	102	cl	sc	5.6	5.1	0.6	4.7	61.1	
	Shettikerei	3-5	20	04	St1	St4	83	gsl	gscl	8.3	6.9	0.9	60.4	68.9	
	Dyavapatna	See unit 3													
19	Madihalli	3-6	22	04	St0	St0	110	sl	sc	6.8sd	7.1	0.7	60	79.5	
	Dyavapatna	See Unit 2													
20	Nittur	See Unit 11													
	Kanatur	1-3	5	01	St1	St1	102	cl	cl	7.5	8.3	0.9	38.9	94.9	
	Lakkanpalya	See Unit 11													
21	Shimsha	1-2	11	04	St1	St4	140	scl	gscl	6.7	6.9	1.0	45.6	93.7	
	Nittur	See Unit 11													
	Lakkanpalya	See Unit 11													
22	Uimala	3-10	25	D4	St4	St4	42	gsc	gsc	7.2	7.0	1.95	43.7	82.6	
	Sivasandra	3-15	20	D5	St4	-	20	gscl	-	8.3	-	2.44	35.6	98.1	
	Matha	3-10	22	D4	St4	St2	45	gscl	gscl	7.8	7.1	0.95	-	72.9	
23	Honnavalli	3-10	t0	D4	St2	St4	81	gsl	gscl	6.1	6.0	0.4	46.1	73.1	
	Virapuram	3-18	II	D4	St3	SO	60	gscl	gc	7.6	7.3	0.95	63.5	93.3	
	Uimala	See Unit 22													
24	Virapuram	See Unit 23													
	Doddagimi	3-10	17	D4	St0	St4	141	c	gc	5.5	6.7	1.1	-	50.5	
	Himnavalli	See Unit 23													
25	Doddaguni	See Unit 24													
	Virapuram	See Unit 23													
26	Doddaguni	See Unit 24													
	Kadabagere	See Unit 18													
27	Kodigehalli	1-10	6	D4	St0	St1	131	c	c	7.9	7.7	0.8	-	97.3	
	Doddaguni	See Unit 24													
28	Sira	1-5	15	D3	St1	St1	30	c	gc	7.3	8.1	1.1	-	99.0	
	Kodigehalli	See Unit 27													
29	Kanatur	See Unit 20													
	Hampalapura	1-2	0	D2	St1	St1	163	sl	c	7.0	7.6	0.4	32.4	78.1	
30	Hamplapura	See Unit 29													
	Kanatur	See Unit 20													

Table 14. Criteria for assessing soil suitability for Ragi

Soil site characteristics	Degree of limitation				
	None	Slight	Moderate	Severe	Very severe
Climate (Annual rainfall in mm)	>750	650-750	650-550	400-550	<400
Topography (Slope percent)	1-3	3-5	5-10	10-15	>15
Drainage	Moderately	Imperfectly drained	poorly/ excessively drained	Poorly drained	-
Texture	loam, silt loam, sandy loam	clay loam, silty clay loam, sandy clay loam	loamy sand, silty clay, clay, sandy clay	sand, heavy clay	-
Gravelliness/ Stoniness volume %					
Surface	0-15	15-35	35-50	50-75	>75
sub-surface	0-35	35-50	50-75	>75	
Base saturation (%)	>80	50-80	35-50	<35	

Table 15 Sutability classification of soils for Ragi- Tumkur District, Karnataka

Soil Mapping Unit	Series Association	Degree of limitation due to											
		Climate	Topography	Drainage	Texture		Gravels Stoniness		Soil Depth	CEC	Base Saturation	Overall limitation	Suitability class
					Surface	Soil control section	Surface	Soil control section					
1	Rock outcrops	-	-	-	-	-	-	-	-	-	-	4	N2
2	Rock out crops Madakasira Kuruganahalli	2	1-0	0	2-0	1	0	1-2	1-0	0	1-0	1-2	S2-S3
3	Dyavaapatna Gubbi Rock outcrops	0	1-0	0	2-0	2-1	0	3-2	0	0	1	2-3	S3-N2
4	Madakasira Kottacheruvu Oblapura	2	1-2	0	2	1	2-0	2	1-0	0	1	1-2	S2-S3
5	Vallur Kottacheruva	2	1-0	0	2-0	1	0	1-2	1-0	0	1-0	1-2	S2-S3
6	Gubbi Dyavapatna Kottacheruvu	0-2	1-0	0	2-0	2-1	0	2-3	0	0	1-0	1-2	S2-S3
7	Kottacheruvu Mudakasira Dyavapatna	0-2	1-2	0	2-0	2-1	2-0	2-3	0-1	0	1	1-2	S2-S3
8	Brahamanapalle Kottacheruvu	0-2	1-2	0	1-2	1-2	0	0-2	0	0	0	1-2	S2-S3
9	Kadamalakunte Velur	2	0	0	0	1	1-2	2-3	1-0	0	0	2	S3
10	Arasikere Kottacheruvu	2	0-1	0	0-2	1-2	0-2	2	1-0	0	0	1-2	S2-S3
11	Lakkanpalya Nittur	0	0	1	1-2	2	0	0	1-0	0	0	1-2	S2-S3
12	Paddamanuturu Channakeshavapura	2	0	I	2-1	0-2	0	0-2	1-0	0	0	1-2	S2-S3

13	Jayamangali Karidasana-halli	0	0	1-0	0-2	0-1	0	0	0	0	0	0	S2
14	Pnnar Roppam Kumudvati	0-2	0	0-1-2	2-1	1-0	0	0	0-1	0	0	1-2	S2-S3
15	Hospura Kuruganahalli	0-2	1-2	0-2	0-1	2	0-3	2	4-1	0	0	3-4	N1-N2
16	Ankalakoppa Hospura	0	1-2	0	1	2	0	2	1	0	0	1-2	S2-S3
17	Bidare Dyavapatna Gubbi	0	0-1	0	0-2	1-2	0	2	0	0	0	1-2	52-S3
18	Kadabagere Shettikerei Dyavapatna	0	0-1	0	0-1-2	1-2	0	0-3	0-1	0	0	1-2	S2-S3
19	Madihalli Dyavapatna	0	1	0	0-2	2	0	0-3	0	0	0	2	S3
20	Nittur Kanatur Lakkanpalya	0	0-2	1-2	1-2	1-2	0	0	0-1	0	0	1-2	S2-S3
21	Shimsha Nittur Lakkanpalya	0	0	0-1	1-2	1-2	0	0-3	0-1	0	0	1-2	S2-S3
22	Unnala Sivasandra Matha	1	1-3	0-2	0-1	1-2	3	1-3	2-3	0	0	2-3	S3-N1
23	Honnavalli Virapuram Unnala	1	1-4	0	0-1	1-2	1-2-3	3	1-2	0	0	3-4	N1-N2
24	Virapuram Doddaguni Honnavalli	0-1	1-4	0	0-1-2	1-2	0-1-2	3	0-1	0	0	34	N1-N2
25	Doddagumi Virapuram	0-1	1-4	0	0-2	2	0-1	3	0-1	0	0	3-4	N1-N2
26	Doddaguni Kadabagere	0	1-2	0	1-2	2	0	0-3	0	0	0	1-2	S2-S3
27	Kodigehalli Doddaguni	0	1-2	0	2	2	0	0-3	0	0	0	1-2	S2-S3
28	Sira Kodigehalh	0-2	0-1	0	2	0	0	0-2	0	0	0	2	S3
29	Kanatur Ham palapura	0-2	1	3-1	0-1-2	1-2	0	0	0	0	0	2-3	S3-N1
30	Hamplapura Kanatur	0-2	1	1-2	1-2	1-2	0	0	0	0	0	1-2	S2-S3

Land on which sustained use of the kind under consideration is expected to yield benefits without unacceptable risk to land resources.

S-1 Highly suitable

Land unit (s) represent (s) optimum conditions for plant growth, without limitations or with only slight limitations.

S-2 Moderately suitable

Land units representing nearly optimal conditions, affects productivity by 20% or less; have slight limitations and/or not more than 3 moderate limitations.

S-3 Marginally suitable

Land units representing moderate conditions, affects productivity significantly, but still economical (marginally); have more than 3 moderate limitations and/or no more than 1 severe limitation that, however, does not preclude the use of the land.

Order 'N' Not suitable

Land which has qualities that appear to preclude sustained use of the kind under consideration.

N-1 Currently Not suitable

Land units representing marginal conditions and uneconomical to use, has one severe limitation that precludes the use of the land, or more than one severe limitation that can be corrected.

N-2 Permanently Not suitable

Land units which yield below the profitable level: inhibiting use of the land for considered land use: have severe or very severe limitations which preclude use of the land and which cannot be corrected.

5.5.1 Land suitability for Ragi (Finger millet)

The general details of the land suitability classes for Ragi is given in table 16. The data indicates that 63.48% of the area falls under the class moderately to marginally suitable, 5.14% is moderately suitable and 4.05% is marginally suitable. The limitations are due to several reasons; gravelliness, stoniness, rock outcrops are some of them. A map showing the suitability of soils for Ragi has been prepared (Fig.23).

Table 16. Suitability of soil mapping units of Tumkur District, Karnataka for ragi

Map Symbol	Suitability Class	Soil mapping units	Area in ha (%)
1	S2 (Moderately suitable)	13	54813 (5.1)
2	S3 (Marginally suitable)	9,19,28	43177 (4.0)
3	S2-S3 (Moderately suitable to Marginally suitable)	4, 5, 6, 7, 8, 10,11, 12,14, 16, 17,18,20, 21, 26, 27, 30	675680 (63.5)
4	S3-N1 (Marginally suitable to presently not suitable)	3,22,29	94807 (8.9)
5	S3-N2 (Marginally suitable to permanently not suitable)	2	25023 (2.4)
6	N1-N2 (Presently not suitable to Permanently not suitable)	15,23,24,25	148252 (13.9)
7	N2 (Permanently not suitable)	1	23003 (2.2)

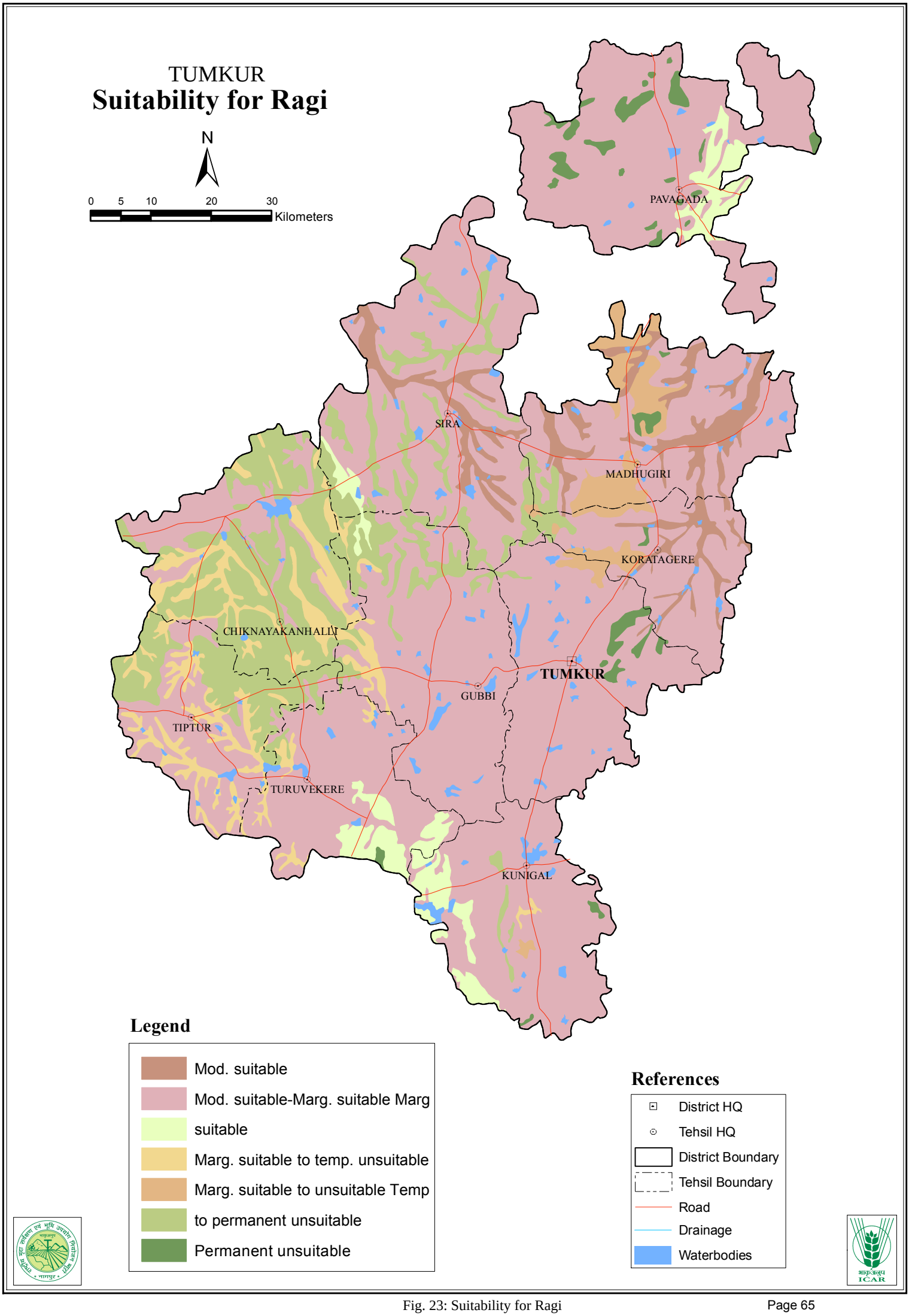


Fig. 23: Suitability for Ragi

5.5.2 Land suitability for paddy

Land suitability for paddy, the important food crop of the district grown in the irrigated areas has been worked out in a similar way. The limitation ratings outlined by Sehgal (1988) with a slight modification to suit the local conditions have been used as the criteria for assessment (Table 17). The degree of limitations allocated for each property in respect of each soil mapping unit is shown in Table 18. A summary of the, suitability classes of the various soils is given in table 19. A map showing the distribution of the suitability of soils for paddy has been prepared of the total area, 13.94% is moderately to marginally suitable, 7.34% moderately suitable, and 68.73% is marginally suitable to presently not suitable. The limitations are due to several reasons as indicated for Ragi Slope is an additional important factor for paddy (Fig.24).

Table 17. Criteria for assessing suitability for paddy

Soil site characteristics	Degree of limitation				
	None	Slight	Moderate	Severe	Very Severe
Topography (Slope %)	0-1	1-3	3-5	5-8	>8
Wetness					
- Flooding	Moderate	Strong	Severe	Very severe	
- Drainage	Imperfectly drained	Moderately well drained/ poorly drained	Poorly/ excessively drained	Excessively drained	
Texture	loam, silt loam, sandy loam	clay loam, silty clay loam, sandy clay loam	loamy sand, silty clay, clay, sandy clay	sand, heavy clay	
Gravelliness/ Stoniness volume %					
Surface	<3	3-15	15-40	40-75	<75
sub-surface	<15	15-40	40-75		
Soil depth (cm)	>80	50-80	25-50	<20	
Cation exchange capacity (meq/ l00g)	>16	10-16	5-10	<5	-
Base saturation (%)	>80	50-80	35-50	<35	-
Electrical conductivity (1:2.5 water)	<2	2-4	4-8	8-15	>15

Table 18 Sutability classification of soils for Paddy- Tumkur District, Karnataka

Soil Mapping Unit	Series Association	Degree of limitation due to													
		Climate	Topography	Flooding	Drainage	Texture		Gravels Stoniness		Soil Depth	CEC	Base Saturation	Soil Salinity	Overall limitation	Suitability class
						Surface	Series control section	Surface	Series control section						
1	Rock outcrops	-	-	-		-	-	-	-	-	-	-		-	N2
2	Rock out crops Madakasira Kuruganahalli	-	2	-	1	2-3	-	4	3	1-3	0	0	0	3-4	N1-N2
3	Dyavaapatna Gubbi Rock outcrops	-	0-1	-	1	2-3	-	2-4	0	0	0	0	0	3-4	N1-N2
4	Madakasira Kottacheruvu Oblapura	-	1-2	-		2-3	-	0-3	3	0-1	0	0	0	2-3	S3-N1
5	Vallur Kottacheruva	-	1	-	1	2-3	-	1	3	0-1	0	0	0	2-3	S3-N1

6	Gubbi Dyavapatna Kottacheruvu	-	1	-	1	2-3	-	0	3-4	0	0	0	0	3-4	N1-N2
7	Kottacheruvu Mudakasira Dyavapatna	-	1-2	-	1	2-3	-	0-3	3	0-1	0	0	0	2-3	S3-N1
8	Brahamanapalle Kottacheruvu	-	1	-	1	2-3	-	0	0-3	0	0	0	0	2-3	S3-N1
9	Kadamalakunte Velur	-	0	-	1	2	-	1-3	3	0-1	0	0	0	2-3	S3-N1
10	Arasikere Kottacheruvu	-	0-1	-	1	2-3	-	0-3	3	0	0	0	0	2-3	S3-N1
11	Lakkanpalya Nittur	0-1	-	0	0	0-1	-	1	0-1	0-1	0	0	0	1	S2
12	Paddamanuturu Channakeshavapura	0-1	-	0	1	1	-	1	2	0-1	0	0	0	1-2	S2-S3
13	Jayamangali Karidasana-halli	0-1	-	0	0-1	0-2	-	0	0	0	0	0	0	1-2	S2-S3
14	Pnnar Roppam Kumudvati	0-1	-	0	0-1-2	0-2-3	-	0-1	0-1	0-1	0	0	0	2-3	S3-N1
15	Hospura Kuruganahalli	-	1-2	-	1	1-3	-	0-3	3	0-3	0	0	0	2-3	S3-N1
16	Ankalakoppa Hospura	-	1-2	-	1	1	-	0-1	3	0-1	0	0	0	2-3	S3-N1
17	Bidare Dyavapatna Gubbi	-	0-1	-	1	1-2-3	-	0	3	0	0	0	0	2-3	S3-N1
18	Kadabagere Shettikerei Dyavapatna	-	0-1	-	1	1-2-3	-	0-1	0-3	0	0	0	0	2-3	S3-N1
19	Madihalli Dyavapatna	-	1	-	1	2-3	-	0	0-3	0	0	0	0	2-3	S3-N1
20	Nittur Kanatur Lakkanpalya	0-1	-	0	0-1	0-1	-	1	0-1	0-1	0	0	0	1	S2
21	Shimsha Nittur Lakkanpalya	0-1	-	0	0-1	0-1	-	1	0-4	0-1	0	0	0	1-4	S2-N2
22	Unnala Sivasandra Matha	-	1-2-3	-	1	1-2	-	3	2-3	2	0	0	0	2-3	S3-N1
23	Honnavalli Virapuram Unnala	-	1-2-3	-		0-1	-	2-3	3	0-1	0	0	0	2-3	S3-N1
24	Virapuram Doddaguni Honnavalli	-	1-2-3	-	1	0-1-2	-	2-3	3	0-1-2	0	0	0	2-3	S3-N1
25	Doddagumi Virapuram	-	1-2-3	-	1	0-1	-	0-3	3	0-2	0	0	0	2-3	S3-N1
26	Doddaguni Kadabagere	-	0-1-2	-		1-2	-	0	0-3	0	0	0	0	2-3	S3-N1
27	Kodigehalli Doddaguni	-	0-1-2	-	1	0	-	0	3	0	0	0	0	2-3	S3-N1
28	Sira Kodigehalh	-	0-1	-	1	0-	-	0-1	1	0-2	0	0	0	1-2	S2-S3
29	Kanatur Ham palapura	0-1	-	0	0-1	1-2	-	0	0	0	0	0	0	1-2	S2-S3
30	Hamplapura Kanatur	0	-	0	0-1	1-2	-	0	0	0	0	0	0	1-2	S2-S3

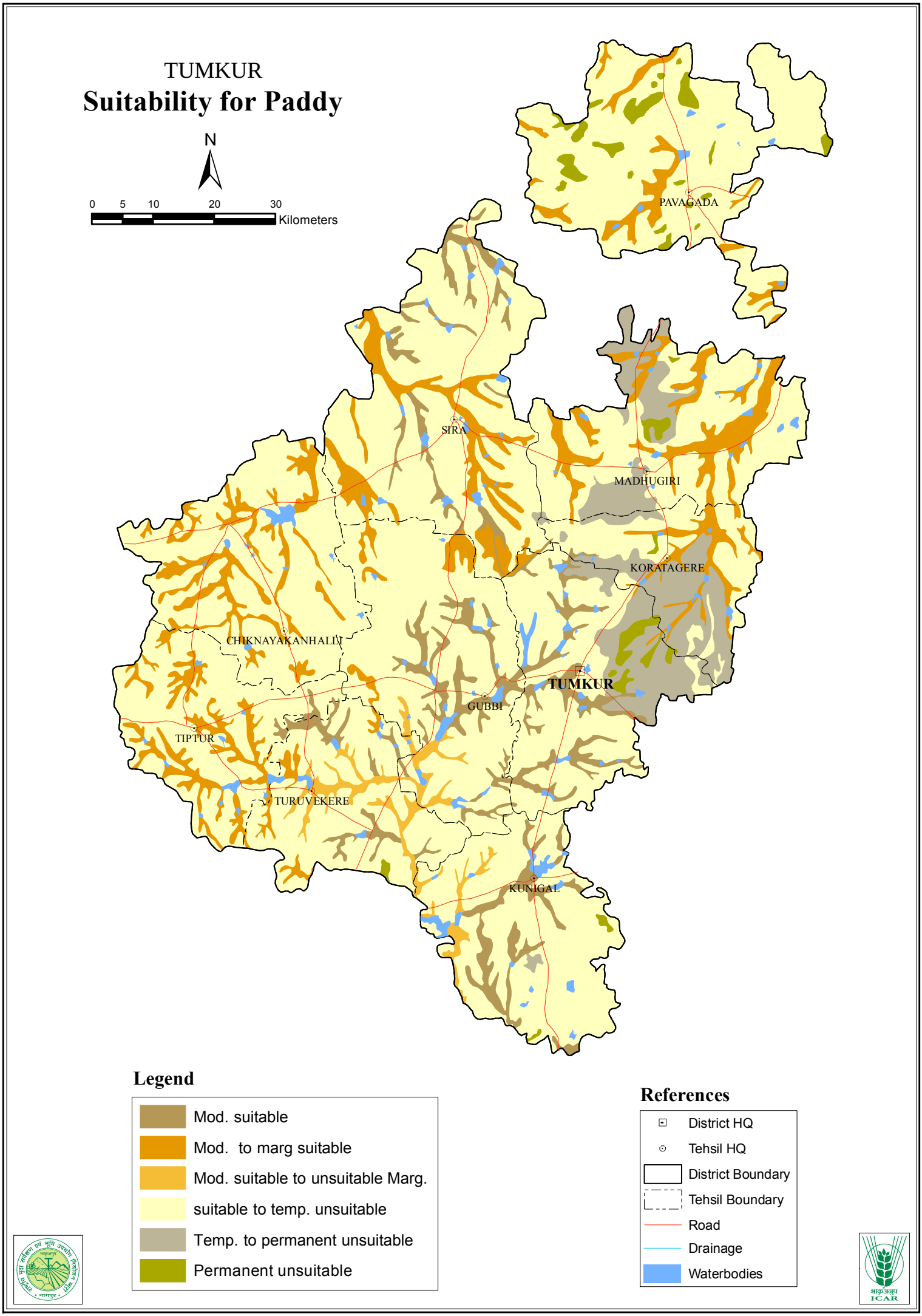


Fig. 24: Suitability for Paddy

Table 19. Suitability of soils for paddy, Tumkur District, Karnataka

Map Symbol	Suitability Class	Soil mapping units	Area in ha (%)
1	S2 (Moderately suitable)	11, 20	78233 (7.3)
2	S2-S3 (Moderately suitable to Marginally suitable)	12,13,28,29,30	148186 (13.9)
3	S2-N2 (Moderately suitable to permanently not suitable)	21	11327 (1.1)
4	S3-N1 (Marginally suitable to presently not suitable)	4, 5, 7, 8, 9, 10, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27	731874 (68.7)
5	N1-N2 (Presently not suitable to Permanently not suitable)	2,3,6	72132 (6.8)
6	N2 (Permanently not suitable)	1	23003 (2.2)

5.5.3 Land suitability for groundnut

Soil suitability for groundnut, the important oil seed crop of the district grown in 20.6% of the area has been worked out. The limitation ratings outlined by Sys (1985) with slight modifications to suit the local conditions have been used as the criteria for assessment (Table 20). The degree of limitations allocated for each property in respect of each of soil mapping unit is shown in Table 21 and Fig.25. A summary of the suitability classes of the various soils is given in table 22. A map showing the distribution of the suitability of soils for groundnut has been prepared of the total area, 10.7% is moderately suitable and 66.6% is marginally to moderately suitable for groundnut cultivation. The limitations are due to several reasons, texture and surface crusting are important parameters.

Table 20. Criteria for assessing soil suitability for groundnut

Soil site characteristics	Degree of limitation				
	0 None	1 Slight	2 Moderate	3 Severe	4 Very Severe
Climate (Temp.°C)	24-33	33-35	22-20	<20	
LGP days (bunch) (spreading)	105-120 120-135	90-105 105-120	<90 90-105	<90	
Topography (Slope per cent	0-1	1-3	3-10	10-15	>15
Drainage	Well drained	Moderately well drained	Imperfectly Drained	Poorly somewhat excessively drained	poorly/ excessively drained
Texture	sandy loam	loamy sand. sandy clay loam	Clay loam, sandy clay	sand, clay, silty clay	
Gravelliness/Stoniness volume %					
Surface	0-15	15-35	35-50	50-75	>75
sub-surface	15-35	35-50	50-75	>75	-
Soil depth (cm)	>80	80-50	50-25	25-15	>15
Cationexchange capacity (meg/100 g)	>16	10-16	5-10	<5	-
Base saturation (%)	>80	50-80	35-50	<35	

Table 21. Suitability classification of soils for groundnut - Tumkur District, Karnataka

Soil Map Unit	Series Association	Degree of limitation due to														Suitability class soil map unit
		Rain fall	Topography		Flod ding	Drain age	Texture		Gravel & Stones		Soil Depth	CEC dsm/kg	Base Saturation	Salinity	Surface crusting	Suitability class Individual series	
			Plains	Undulating to rollimg			Sur face	Silt + clay	Sur face	Sub soil							
1	Rock outcrops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N2	N2
2	Rock out crops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N2	N2-S3
	Madakasira	1	-	2	0	0	1	-	2-3	1-2	1	0	1	-	-	S3	
	Kuruganahalli	1	-	2	0	1	1	-	3	-	4	-	-	-	-	N2	
3	Dyavaapatma	0	1	-	0	0	1	3	0	2	0	0	1	-	-	S3	S3-N2
	Gubbi	0	0	-	0	1	0	3	0	1-2	0	0	1	-	2	S3	
	Rock outcrops	0	-	-	-	-	-	-	4	-	-	-	-	-	-	N2	
4	Madakasira	1	-	2	0	0	1	-	2-3	1-2	1	0	1	-	-	S3	S3-S3
	Kottacheruvu	-	1	-	-	0	0	1	-	0	1-2	0	0	-	-	S3	
	Oblapura	1	1	-	-	0	0	2	-	0	1-2	0	-	0	0	S3	
5	Vallur	1	0		-	0	1	-	1-2	0-1	1-3	0	0	-	-	S3	S3-S3
	Kottacheruvu	Please refer Unit 4														S3	
6	Gubbi	Please refer Unit 3														S3	S3
	Dyavapatna	Please refer Unit 3														S3	
	Kottacheruvu	Please refer Unit 4														S3	
7	Kottacheruvu	Please refer Unit 4														S3	S3-S3
	Mudakasira	Please refer Unit 2														S3	
	Dyavapatna	Please refer Unit 3														S3	
8	Brahmanapalle	1	1	-	0	1	1	-	0	0	0	0	0	-	-	S3	S3
	Kottacheruvu	Please refer Unit 4														S3	
9	Kadamalakunte	1	0	-	0	0	0	-	1-2	2	1	0	0	-	-	S3	S3
	Vallur	Please refer Unit 5														S3	
10	Arasikere	1	0	-	0	0	0	-	1-2	1-2	0	0	0	-	-	S3	S3
	Kottacheruvu	Please refer Unit 4														S3	
11	Lakkanpalya	0	0	-	0	2	3	-	0	0	1	0	0	-	-	S3	S3
	Nittur	0	0	-	0	2	1	-	0	0	0	-	0	-	-	S3	
12	Paddamanuturu	1	0	-	0	3	2	-	0	1-2	1	-	0	1	-	S2	S2
	Channakcshavapura	1	0	-	0	3	2	-	0	0	0	0	0	-	-	S2	
13	Jayamangali	1	0	-	1	0	0	-	0	0	0	0	1	-	-	S2	S2
	Karidasanahalli	1	0	-	-	2	3	-	0	0	0	0	0	-	-	S2	
14	Pnnar	1	0	-	0	4	1	-	0	0	0	-	-	-	-	N1	N1-S2
	Roppam	1	0	-	0	0	0	-	1	0	1	0	0	-	-	S2	
	Kumudvati	1	0	-	0	3	3	-	0	0	0	0	0	-	-	S2	
15	Hospura	1	-	1-3	0	0	1	-	0	1-2	0	2	-	-	-	S3	S3-N2
	Kuruganahalli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N2	

16	Ankalakoppa		-	1-3	0	0	1	-	0-1	1-2	1	0	0	-	-	S3	S3-N2
	Hospura	Please refer Unit 15														N2	
17	Bidare	0	0	-	0	1	0	3	0	1-2	1	0	0	-	1	N1	
	Dyavapatna	Please refer Unit 3														S3	
	Gubbi	Please refer Unit 3														S3	
18	Kadabagere	0	0-1	-	0	0	2	3	0	0	0	0	1	-	-	S3	S3
	Shetlikere	0	1	-	0	0	0	3	0	2	0	0	1	-	-	S3	
	Dyavapatna	Please refer Unit 3														S3	
19	Madihalli	1	1	-	0	0	0	-	0	0	0	0	1	-	-	S3	S3
	Dyavapatna	Please refer Unit 3														S3	
20	Nittur	Please refer Unit 11														S3	S3
	Kanatur	1	0	-	0	3	2	3	0-1	0	0	0	0	-	-	S3	
	Lakkanpalya	Please refer Unit 11														S3	
21	Shimsha	0	0	-	0	0	1	3	0-1	0	0	0	0	-	-	S3	S2
	Nittur	Please refer Unit 11														S2	
	Lakkanpalya	Please refer Unit 11														S2	
22	Unnala	1	-	1-2	0	0	1	-	3	2	2	0	0	-	-	S3	S3-N1
	Sivasandra	1	-	1-2	0	4	1	-	3	-	3	0	0	-	-	N1	
	Matha	1	-	1-2	0	0	1	-	3	0	2	-	1	-	-	S3	
23	Honnavalli	1	-	1-2	0	0	0	-	1	2	0	0	1	-	-	S3	S3-S3
	Virapurum	1	-	1-4	0	0	1	-	3	2	1	0	0	-	-	S3	
	Unnala	Please refer Unit 22														S3	
24	Virapuram	Please refer Unit 23														S3	S3-S3
	Diddaguni	1	-	1-2	0	0	3	3	0	2	0	-	1	-	-	S3	
	Honnavalli	Please refer Unit 23														S3	
25	Doddaguni	Please refer Unit 24														S3	S3
	Virapuram	Please refer Unit 23														S3	
26	Doddaguni	Please refer Unit 24														S3	S3-S3
	Kadabagere	Please refer Unit 18														S3	
27	Kodigehalli	0	S3	-	-	-	3	-	0	0	0	-	1	-	-	S3	S3-S3
	Doddaguni	Please refer Unit 24														S3	
28	Sira	1-2	S3	-	0	1	3	-	0	0	2	-	0	-	-		S3-S3
	Kodigehalli	Please refer Unit 3														S3	
29	Kanatur	Please refer Unit 20														S3	S3
	Hamplapura	1	S3	-	-	2	0	-	0	0	0	0	1	-	-		
	Nittur	Please refer Unit 20														S3	
30	Hamplapura	Please refer Unit 29														S3	S3
	Kanatur	Please refer Unit 20														S3	

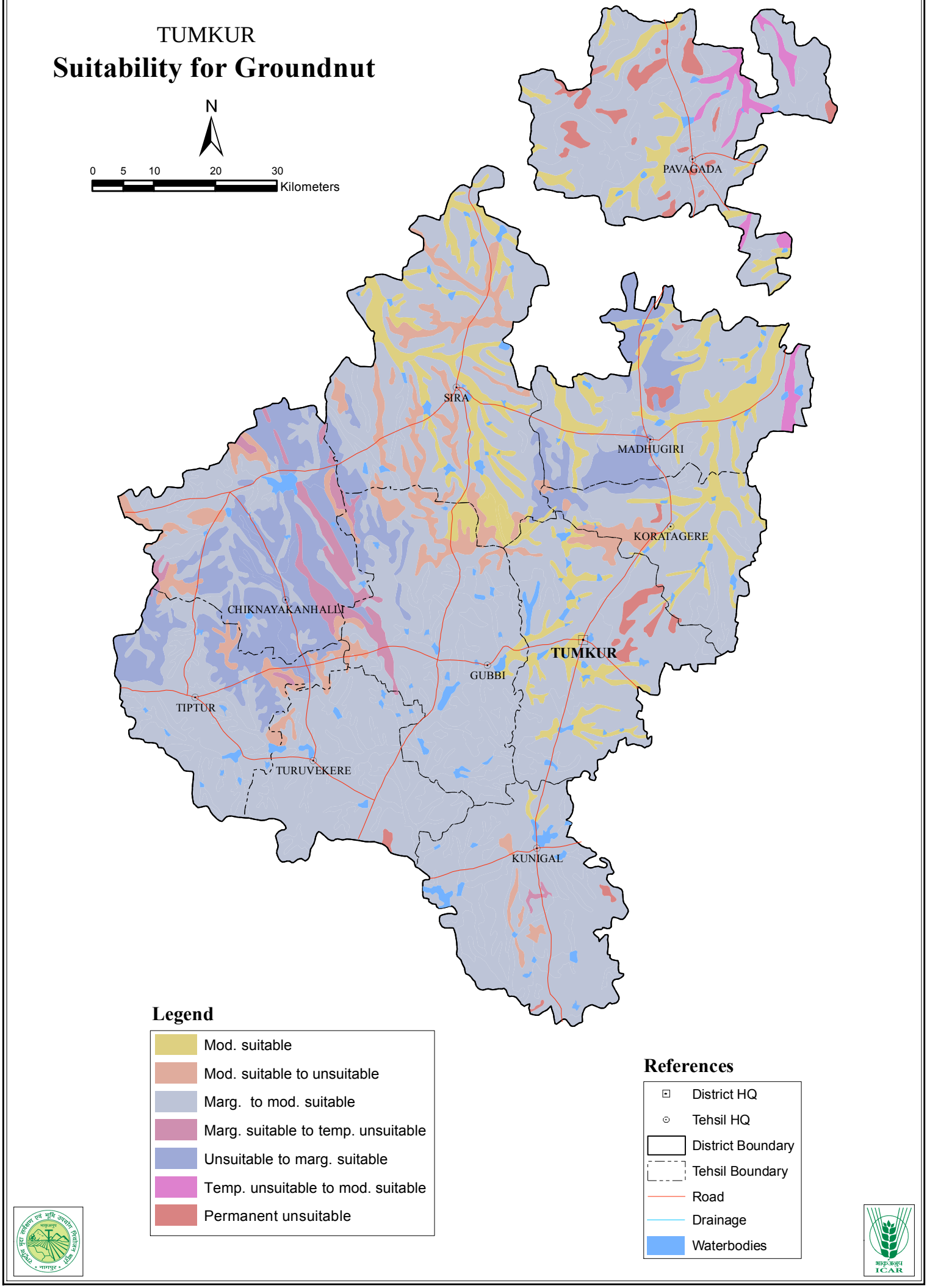


Fig. 25: Suitability for Groundnut

Table 22. Suitability of soil mapping units, Tumkur District, Karnataka for groundnut

Map Symbol	Suitability Class	Soil mapping units	Area in ha (%)
1	S2 (Moderately suitable)	11,12,13	113802 (10.7)
2	S2-S3 (Moderately suitable to permanently not suitable)	3,15,23	71211 (6.7)
3	S3-S2 (Marginally suitable to Moderately suitable)	4, 5, 6, 7, 8,9,10,16,17,18, 19, 20, 21, 26,27,28,29,30	709133 (66.6)
4	S3-N1 (Marginally suitable to presently not suitable)	22	15776 (1.5)
5	N1-S2 (Presently not suitable to Permanently not suitable)	14	5064 (0.5)
6	N2-S3 (Permanently not suitable to marginally suitable)	2,4,25	126776 (11.9)
7	N2 (Permanently not suitable)	1	23003(2.2)

5.5.4. Soil suitability for coconut

Soil suitability for coconut, which is cultivated over a large area in southern parts of the district and to a limited extent in other parts of the district, has been worked out. The limitation ratings outlined by Sys (1985) with slight modifications to suit local conditions have been used as the criteria for assessment (Table 23). The degree of limitations allocated for each property in respect of each soil-mapping unit is shown in Table 24. A summary of the suitability classes of the various soils is given in Table 25. A map showing the distribution of the suitability of soils for coconut has been prepared of the total area 11.3% is moderately suitable. The limitations are due to several reasons, which are specific to the cultivation of this important cash crop. Coconut cultivation is restricted to valley lands which will have sufficient moisture throughout the year with supplemental irrigation where ever available overcomes the climatic limitation (Fig.26).

Table 23. Criteria for assessing soil suitability for coconut

Soil site characteristics	Degree of limitation				
	None	Slight	Moderate	Severe	Very Severe
Climate -Rainfall mm	>1500	1000-1500	500-1000	400-500	<400
-Dry spell months	<3	4-5	6-7	>6	-
Sunshine hrs/day	6	6-8	8-10 4-6	>10 <4	-
Temperature (°C)	26-29	23-25 30-32	20-22 32-34	<20 >34	
Topography (Slope %)	0-8	8-15	15-30	>30	
Elevation (mts above MSL)	<300	300-600	600-900	>900	
Drainage	Well drained	Moderately well drained	Imperfectly Drained	Poorly somewhat excessively drained	Excessively drained
Texture	sandy loam	loamy sand, sandy clay loam, gravelly clay	clay loam, clay, sandy clay	sand, heavy clay, silty clay	
Gravelliness/ Stoniness volume %					
Surface	0-15	15-35	35-50	50-75	>75
sub-surface	15-35	35-50	50-75	>75	
Soil depth (cm)	100-150	80-100	60-80	40-60	<40
Cation exchange capacity (meg/100 g)	>16	10-16	5-10	<5	-
Base saturation (%)	>80	50-80	35-50	<35	
Water table cm below ground level	>150	100-150	80-100	<80	

Table 24. Suitability classification of soils for Coconut - Tumkur District, Karnataka

Soil Map Unit	Series Association	Degree of limitation due to														Suitability class soil map unit
		Rain fall	Topography		Flooding	Drainage	Texture		Gravel & Stones		Soil Depth	CEC dsm/kg	Base Saturation	Salinity	Surface crusting	Suitability class Individual series	
			Plains	Undulating to rollimg			Surface	Silt + clay	Surface	Sub soil							
1	Rock outcrops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N2	N2
2	Rock out crops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N2	N2-S3
	Madakasira	3	2	0	0	3	-	3-3	3-2	2	-	2	0	-	-	S3	
	Kuruganahalli	3	-	2	0	4	3	-	3	-	4	-	-	0	-	N2	
3	Dyavaapatma	3	3	-	-	0	3	-	0	2	0	0	3	0	-	S3	S3-N2
	Gubbi	3	0	-	-	3	0	-	0	3-2	0	0	3	0	-	S3	
	Rock outcrops	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N2	
4	Madakasira	Please refer Unit 2														S3	S3-S3
	Kottacheruvu	3	3	-	0	0	3	-	0	3-2	0	0	-	0	-	S3	
	Oblapura	3	3	-	0	0	2	-	0	3-2	0	3	-	0	-	S3	
5	Vallur	3	0	-	-	0	0	-	0-3	3-2	3	0	0	0	-	S3	S3
	Kottacheruvu	Please refer Unit 4														S3	
6	Gubbi	Please refer Unit 3														S3	S3
	Dyavapatna	Please refer Unit 3														S3	
	Kottacheruvu	Please refer Unit 4														S3	
7	Kottacheruvu	Please refer Unit 4														S3	S3-S3
	Mudakasira	Please refer Unit 2														S3	
	Dyavapatna	Please refer Unit 3														S3	
8	Brahmanapalle	3	3	-	0	3	3	-	0	0	0	0	0	0	-	S3	S3
	Kottacheruvu	Please refer Unit 4														S3	
9	Kadamalakunte	3	0	-	0	0	0	-	2-3	2	3	0	0	0	-	S3	S3-S3
	Vallur	Please refer Unit 5														S3	
10	Arasikere	3	0	-	0	0	0	-	3-3	3-2	3	0	0	0	-	S3	S3
	Kottacheruvu	Please refer Unit 4														S3	
11	Lakkanpalya	0	0	-	0	2	2	-	0-3	0	2	0	-	0	-	S3	S3
	Nittur	0	0	-	0	2	3	-	0-3	0	0	0	0	0	-	S3	
12	Paddamanuturu	3	0	-	0	3	2	-	0	3-2	2	-	0	3	-	S3	S3
	Channakcshavapura	3	0	-	0	3	2	-	0	0	0	0	-	0	-	S3	
13	Jayamangali	3	0	-	3	0	0	0	0	0	0	0	3	-	-	S3	S3
	Karidasanahalli	3	0	-	0	2	2	0	0	0	0	0	0	-	-	S3	
14	Pnnar	3	0	-	0	4	3	-	0	0	0	-	-	-	-	N2	N2-S3
	Roppam	3	0	-	0	0	0	-	0-3	0	0-2	0	0	-	-	S3	
	Kumudvati	3	0	-	0	2	2	-	0	0	0	0	0	-	-	S3	
15	Hospura	3	-	3-2	0	0	3	-	0	3-2	3	0	2	0	0	S3	S3-N2
	Kuruganahalli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N2	

16	Ankalakoppa	3	-	3-2	0	0	3	-	0-3	3-2	2	0	0	0	-	S3	S3
	Hospura	Please refer Unit 15														S3	
17	Bidare	3	0	-	0	3	0	-	0	3-2	0	0	3	0	0	S3	S3
	Dyavapatna	Please refer Unit 3														S3	
	Gubbi	Please refer Unit 3														S3	
18	Kadabagere	3	0-3	-	-	0	2	-	0	0	0	0	3	0	0	S3	S3
	Shetlikere	3	3	-	-	0	0	-	0	2	3	0	3	0	0	S3	
	Dyavapatna	Please refer Unit 3														S3	
19	Madihalli	3	3	-	-	0	0	-	0	0	0	0	3	0	0	S3	S3
	Dyavapatna	Please refer Unit 3														S3	
20	Nittur	Please refer Unit 13														S2	S2
	Kanatur	0	0	-	0	3	2	-	0-3	0	0	0	0	0	0	S2	
	Lakkanpalya	Please refer Unit 13														S2	
21	Shimsha	0	0	-	0	0	3	-	0	3-2	0	0	0	0	0	S2	S2
	Nittur	Please refer Unit 13														S2	
	Lakkanpalya	Please refer Unit 13														S2	
22	Unnala	3	-	3-2	0	0	3	-	3	2	3	0	0	0	0	S3	
	Sivasandra	3	-	3-2	0	4	3	-	3	-	4	0	0	0	0	N2	
	Matha	3	-	3-2	0	0	3	-	3	0	3	-	3	0	0	S3	
23	Honnavalli	3	-	3-2	0	0	0	-	3	2	3	0	3	0	0	S3	S3-N3
	Virapurum	3	-	3-3	0	0	3	-	2-3	2	2-3	0	0	0	0	N3	
	Unnala	Please refer Unit 22														S3	
24	Virapuram	Please refer Unit 23														N3	N3-S3
	Diddaguni	3	-	3-2	0	0	2	-	0	2	0	-	0	0	0	S3	
	Honnavalli	Please refer Unit 23														S3	
25	Doddaguni	Please refer Unit 24														S3	S3-N3
	Virapuram	Please refer Unit 23														N3	
26	Doddaguni	Please refer Unit 24														S3	S3
	Kadabagere	Please refer Unit 18														S3	
27	Kodigehalli	3	3	-	0	0	2	-	0	0	0	-	0	0	0	S3	S3
	Doddaguni	Please refer Unit 24														S3	
28	Sira	3	0-3	-	0	3	2	-	0-3	0	4	-	0	0	0	N3	N3-S3
	Kodigehalli	Please refer Unit 27														S3	
29	Kanatur	Please refer Unit 20														S2	S2
	Hamplapura	0	0	-	0	2	0	-	0-3	0	0	0	3	0	0	S2	
	Nittur	Please refer Unit 20														S2	
30	Hamplapura	Please refer Unit 29														S2	S2
	Kanatur	Please refer Unit 20														S2	

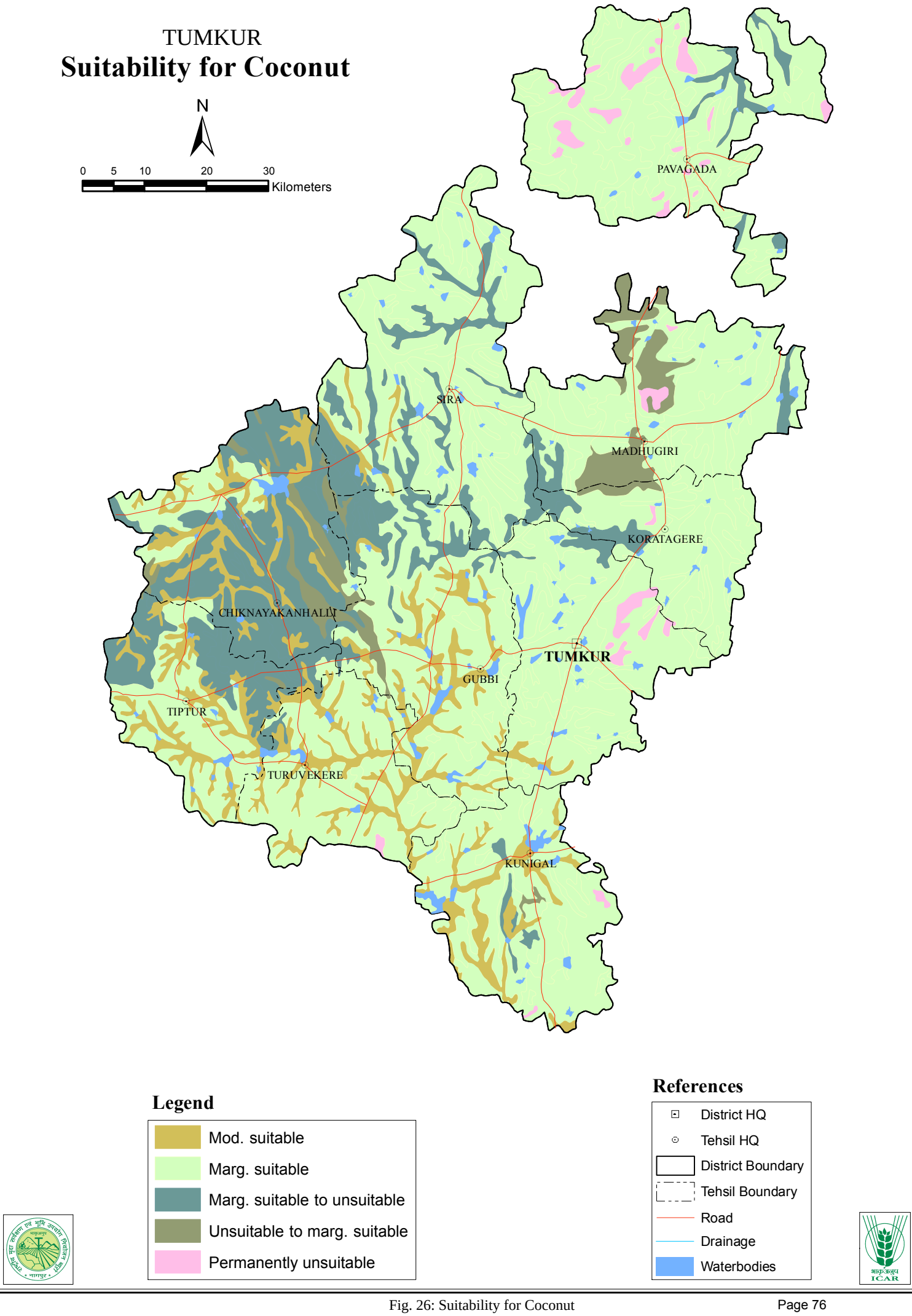


Fig. 26: Suitability for Coconut

Table 25. Suitability of soil mapping units for coconut

Map Symbol	Suitability Class	Soil mapping units	Area in ha (%)
1	S2 (Moderately suitable)	20,21,29,30	120427 (11.3)
2	S3 (Marginally suitable)	4,5,6,7,8,9, 10, 11, 12, 13, 16,17, 18, 19, 26,27	698991 (65.6)
3	S3-N1 (Marginally suitable to presently not suitable)	23,24,25,28	123706 (11.6)
4	S3-N2 (Marginally suitable to presently not suitable)	3,14,15	57829 (5.4)
5	N2-S3 (Presently not suitable toMarginally suitable)	2,22	40799 (3.9)
6	N2 (Permanently not suitable)	1	23003 (2.2)

5.6 Suggested land use

The soil survey of Tumkur district has given information on distribution of soils, their morphological and physical-chemical characteristics. The details of the important crops grown in the district are given in table 3. The interpretation of the soil mapping units for land capability and irrigability classes has also been made. The grouping of the soils into problem and productive soils have been made and described. Considering all these interpretations, a suggested land use has been recommended for different soil mapping units. The recommendations provide a general guideline for proper land use and management. The details are given in Table 26. Suggested land use map prepared is appended (Fig.27).

Table 26.Suggested land use for Tumkur District, Karnataka

Map Symbol	Description	Soil mapping units	Suggested Land use	Area in ha (%)
1	Undulating summits, tors, domes	1	Scrub forest and quarrying wherever possible	23003 (2.18)
2	Undulating hills tors and domes, upper pediments	2, 22, 23, 24, 25	Suitable for grass lands. scrub forest, habitat for wild life, cultivation of dry land crops in patches	160998 (15.12)
3	Rolling lands to undulating lands & gently sloping upper and lower pediments	3, 6, 16, 17, 18, 19, 26, 27, 28, 30	Suitable for: a) Ragi and mixed row crops, groundnut, castor and horsegram b) Mulberry and vegetables under well irrigation	388201 (36.46)
4	Undulating lands gently sloping upper and lower pediments	4,5,7,8,9, 10, 15	Suitable for: a) Groundnut, tur, castor and horsegram b) Ragi and mixed crops	270331 (25.39)
5	Valley lands and river food plains	11, 12, 13, 14, 20, 21, 29	Suitable for: a) Paddy and sugarcane b) Irrigated ragi, mulberry, coconut and vegetables	222222 (20.82)

Land Use/Land Cover map of the district derived from Landsat ETM+ satellite data (2002) is shown in figure 28.

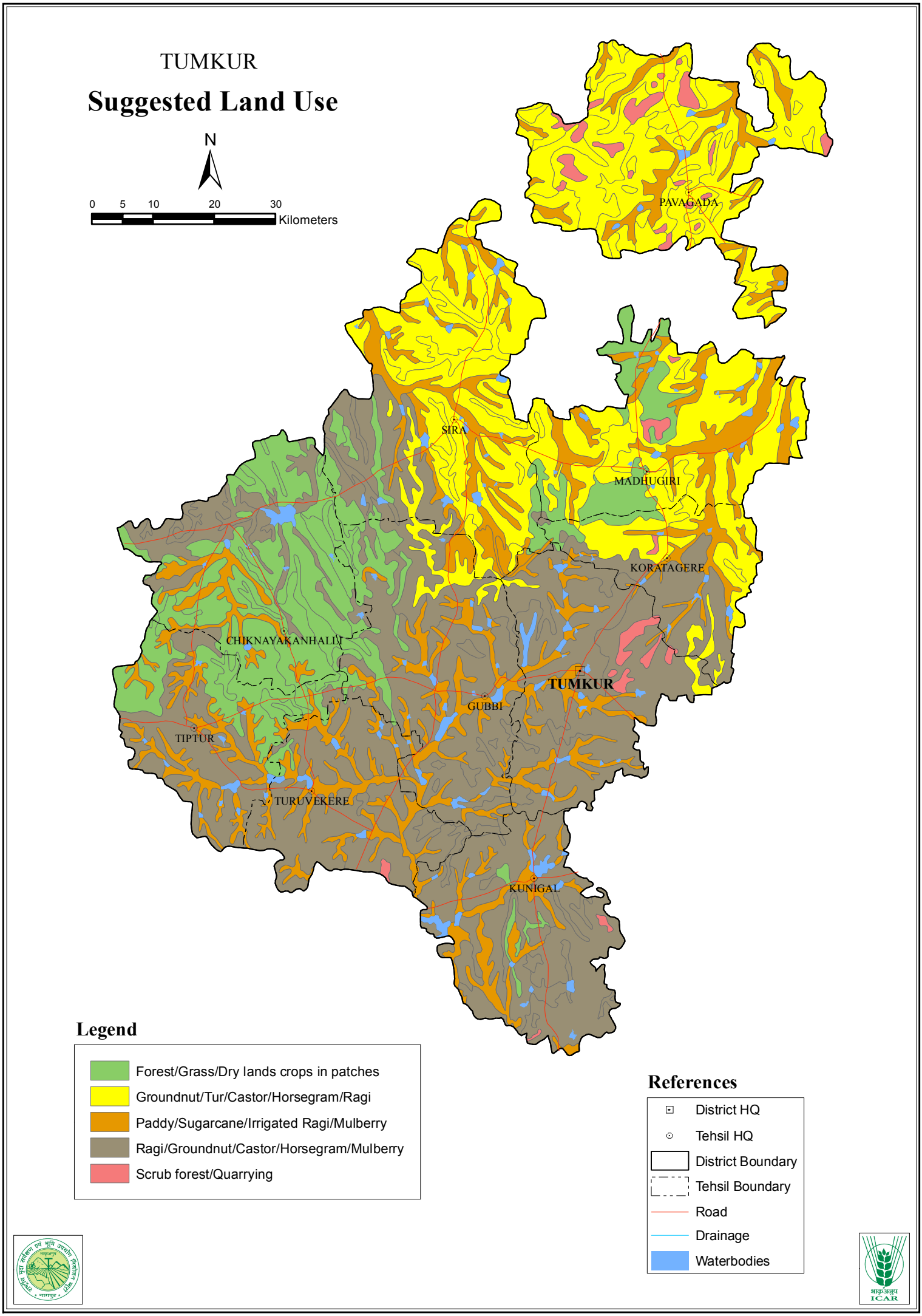
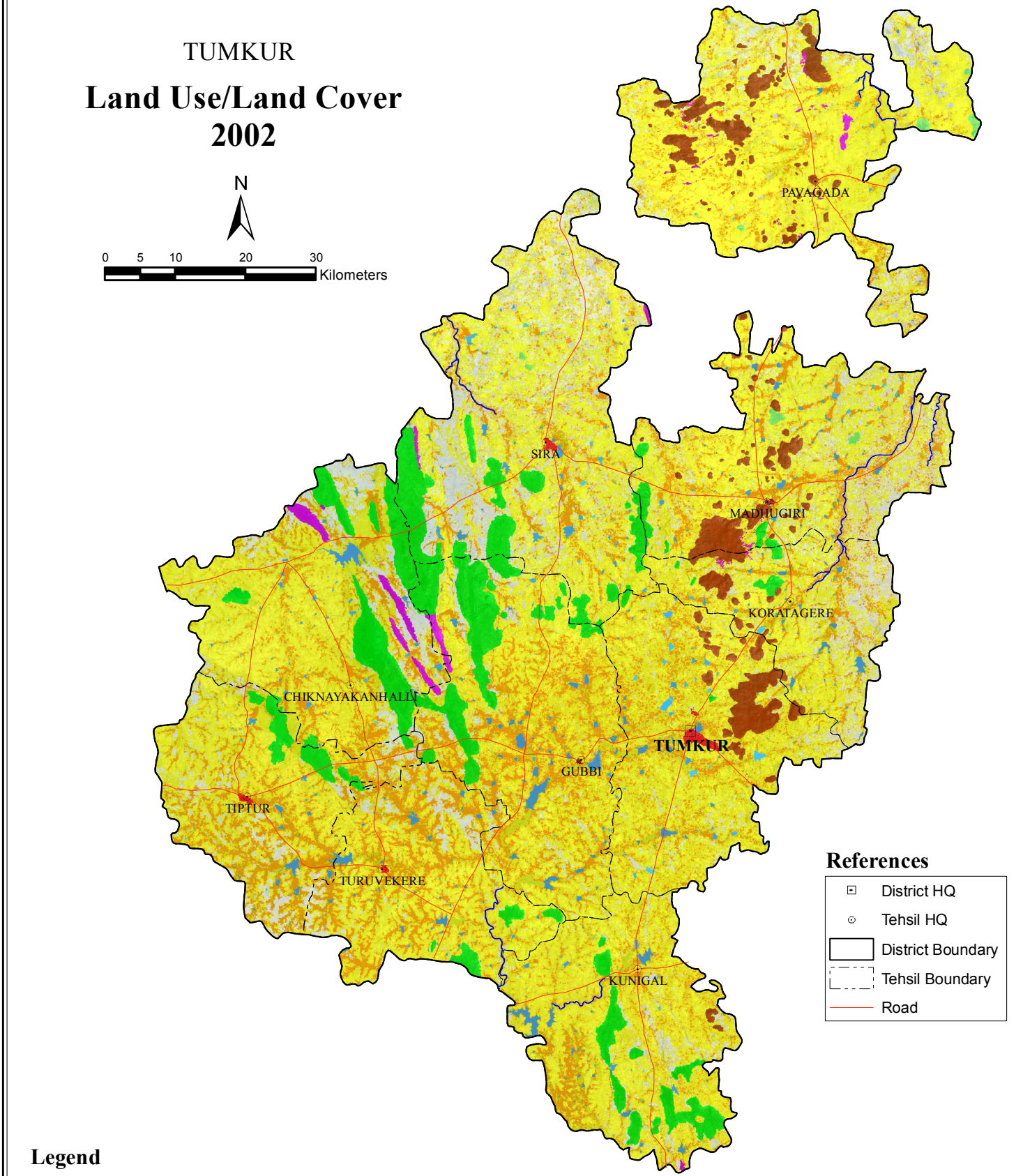


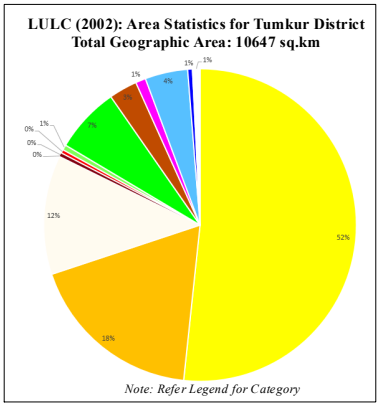
Fig. 27: Suggested Land Use



Legend

Classes	Area [sq.km]
Agriculture	
Agriculture, Cropland	5502
Agriculture, Plantation	1940
Agriculture, Single Crop, Fallow	1314
Builtup	
Built-up, Mining	5
Built-up, Rural	37
Built-up, Urban	39
Forest	
Forest, ScrubForest	57
Forest, Deciduous	724

Classes	Area [sq.km]
Rock outcrops	312
Uncultivable	
Barren/Uncultivable/Wastelands, Scrub Land	112
Water	
Wetlands/Water Bodies, Reservoir/Lakes/Ponds	470
Wetlands/Water Bodies, River/Stream/Canals	52
Others	83



Data Source: Landsat ETM+ Satellite data of Kharif (2002) and Rabi (2002), SRTM DEM, Existing Soil Maps & Reports (NBSS & LUP), and other Statistical Data

Fig. 28: Land Use/Land Cover 2002

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