हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch

Land Resource and Hydrological Inventory of Hale Kumta Sub-watershed for Watershed Planning and Development Koppal Taluk, Koppal District, Karnataka (AESR 3.0)

Sujala – III
Karnataka Watershed Development Project- II
Funded by World Bank

ICAR - NBSS & LUP

THE WORLD BANK

ICAR - National Bureau of Soil Survey and Land Use Planning, Bangalore
Watershed Development Department, Govt. of Karnataka, Bangalore

About ICAR - NBSS&LUP

The National Bureau of Soil Survey and Land Use Planning (ICAR-NBSS&LUP), Nagpur, a premier Institute of the Indian Council of Agricultural Research (ICAR), was set up during 1976 with the objective to prepare soil resource maps at national, state and district levels and to provide research inputs in soil resource mapping and its applications, land evaluation, land use planning, land resource management, and database management using GIS for optimizing land use on different kinds of soils in the country.

The Bureau has been engaged in carrying out soil resource survey, agro-ecological and soil degradation mapping at the country, state and district levels for qualitative assessment and monitoring the soil health towards viable land use planning. The research activities have resulted in identifying the soil potentials and problems, and the various applications of the soil surveys with the ultimate objective of sustainable agricultural development. The Bureau has the mandate to correlate and classify soils of the country and maintain a National Register of all the established soil series. The Institute is also imparting in-service training to staff of the soil survey agencies in the area of soil survey, land evaluation and soil survey interpretations for land use planning. The Bureau in collaboration with Panjabrao Krishi Vidyapeeth, Akola is running post-graduate teaching and research programme in land resource management, leading to M.Sc. and Ph.D. degrees.

Citation: Rajendra Hegde, K.V. Niranjana, S. Srinivas, B.A. Dhanorkar, R.S.Reddy and S.K. Singh (2018). "Land Resource and Hydrological Inventory of Hale Kumta Sub-watershed for Watershed Planning and Development, Koppal Taluk, Koppal District, Karnataka", Sujala SWs-LRI Atlas No.48, ICAR – NBSS & LUP, RC, Bangalore. p.58.

TO OBTAIN COPIES,

Director, ICAR - NBSS & LUP,
Amaravati Road, Nagpur,
Maharashtra - 440 033, India.
Phone : +91-712-2500386, 2500545 (O)
Telefax : +91-712-2500534
E-Mail : director.nbsslup@icar.gov.in
Website URL : https://www.nbsslup.in

Or

Head, Regional Centre, ICAR - NBSS & LUP,
Hebbal, Bangalore,
Karnataka - 560 024, India.
Phone : +91-80-23412242, 23410993 (O)
Telefax : +91-80-23510350
E-Mail : hd_rcb.nbsslup@icar.gov.in
nbssrcb@gmail.com

PART - A

Land Resource Inventory of Hale Kumta Sub-watershed for Watershed Planning and Development

Koppal Taluk, Koppal District, Karnataka (AESR 3.0)

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Contributors

Dr. Rajendra Hegde Principal Scientist, Head & Project Leader, Sujala-III Project ICAR-NBSS&LUP, Regional Centre, Bangalore - 24	National Coordinator **Dr. S.K.Singh** Director, ICAR-NBSS&LUP Nagpur - 33	
Field Work, Mapping & Report Preparation		
Dr. B.A. Dhanorkar	Sh. R.S. Reddy	Dr. Savitha, H.R.
Dr. K.V. Niranjana	Sh. Venkata Giriyappa	Dr. Gayathri, B.
	Sh. Nagendra, B.R.	Dr. Gopali Bardhan
	Smt. Chaitra, S.P.	Sh. Somashekar, T.N.
Field Work		
Sh. C. Bache Gowda	Sh. Mayur Patil	Sh. Shankarappa, K.
Sh. Somashekar	Sh. Arun Kumar, S.	Sh. Lankesh, R.S.
Sh. M. Jayaramaiah	Sh. Sunil Raj	Sh. Appanna B. Hattigoudar
	Sh. Yogesh Kumar, B.	Sh. Maharudra
	Sh. Vikas, N.K.	
	Sh. Arun Kumar, S.G.	
	Sh. Umesh Jadiyappa Madolli	
	Sh. Praveen Kumar P. Achalkar	
	Sh. Veerabhadraswamy	
	Sh. Vinay	
GIS Work		
Dr. S.Srinivas	Sh. A.G.Devendra Prasad	
Dr. M.Ramesh	Sh. Deepak, M.J.	
Sh. D.H.Venkatesh	Smt. K.Karunya Lakshmi	
Smt. K.V.Archana	Ms. Seema, K.V.	
Sh. N. Maddileti	Smt. Ramireddy Lakshmi Silpa	
	Smt. Rajata Bhat	
	Sh. Madappaswamy	
	Smt. Shyla, B.	
	Smt. Swetha ,K.	
	Ms. Vidya, P.C.	

Laboratory Analysis	
Dr. M. Lalitha	Ms. Thara, V.R.
Smt. Arti Koyal	Ms. Ushakiran G
Smt. Parvathy, S.	Ms. Vindhya, N.G.
	Ms. Ashwini Ambadi
	Ms. Pavana Kumari, P.
	Ms. Leelavathy, K.U.
	Ms. Rashmi, N.
	Ms. Mamatha Ajappa Chikkali
	Ms. Veena, M.
	Ms. Chaithrashree B
	Ms. Shwetha N
Socio-economic Analysis	
Dr. Ramesh Kumar, S.C.	Sh. Prakashanaik, M.K.
	Sh. Basavaraj
	Sh. Vinod R
	Smt. Prathibha, D.G.
	Ms. Sowmya, K.B.
Soil & Water Conservation	
Sh. Sunil P. Maske	
Watershed Development Department, GoK, Bangalore	
Sh. Prabhash Chandra Ray, IFS Project Director & Commissioner, WDD	Dr. A. Natarajan NRM Consultant, KWDP-II, Sujala-III, WDD
Sh. A. Padmaya Naik, Director (In-Charge) Executive Director, KWDP-II, Sujala-III, WDD	

How to read and use the Atlas

The Land Resource Inventory of Hale Kumta Sub-watershed (Koppal Taluk, Koppal District) for Watershed Planning (AESR 3.0) was undertaken to provide comprehensive site- specific cadastral level information useful for farm level planning and integrated development of the area under Sujala – III, Karnataka Watershed Development Project- II.

This atlas contains the basic information on kinds of soils, their geographic distribution, characteristics and classification. The soil map and soil based thematic maps derived from soils data on soil depth, soil gravelliness, slope, land suitability for various crops and land use management maps are presented on 1:12,500 scale. The maps of fertility status (soil reaction, organic carbon, available phosphorus, available potassium, available sulphur, available calcium, available copper, available manganese, available zinc, available iron, available boron and salinity (EC) on 1:12,500 scale were derived from grid point sampling of the surface soils from the watersheds.

The atlas illustrates maps and tables that depict the soil resources of the watershed and the need for their sustainable management.

The user, depending on his/her requirement, can refer this atlas first by identifying his/her field and survey number on the village soil map and by referring the soil legend which is provided in tabular form after the soil map for details pertaining to his/her area of interest.

The atlas explains in simple terms the different kinds of soils present in the watershed, their potentials and problems through a series of thematic maps that help to develop site-specific plans as well as the need to conserve and manage this increasingly threatened natural resource through sustainable land use management. The Land Resource Atlas contains database collected at land parcel/ survey number level on soils, climate, water, vegetation, crops and cropping patterns, socio-economic conditions, marketing facilities *etc.* helps in identifying soil and water conservation measures required, suitability for crops and other uses and finally for preparing a viable and sustainable land use options for each and every land parcel.

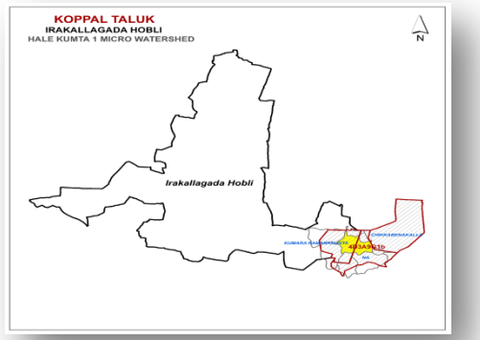
For easy map reading and understanding the information contain in different maps, the physical, cultural and scientific symbols used in the maps are illustrated in the form of colors, graphics and tables.

Physical, Cultural and Scientific symbols used in the Atlas

Each map in the atlas sheet is complemented with the physical, cultural and scientific symbols to facilitate easy map reading.

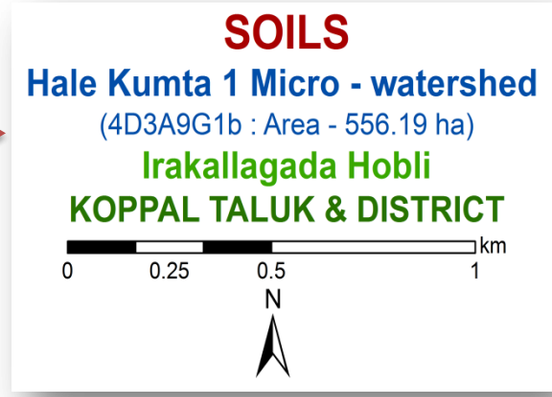
Inset map

Inset provided in each map conveys its strategic location i.e. Taluk, Sub-watershed and Sub-watershed.



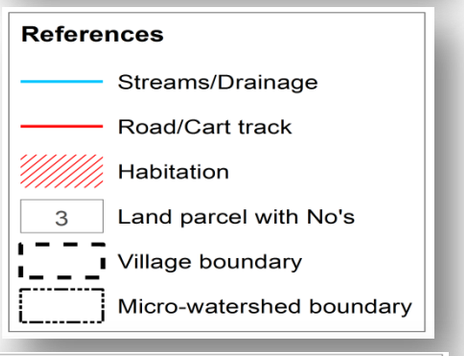
Map title

Map title conveys the relevance of thematic information presented along with a graphical scale, geographical location and watershed details in text form.



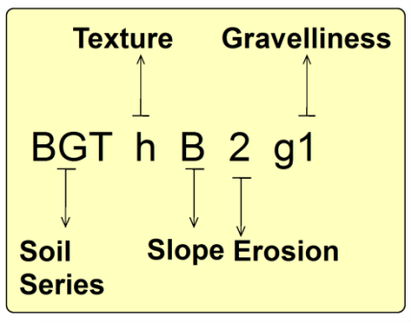
Legends and symbols

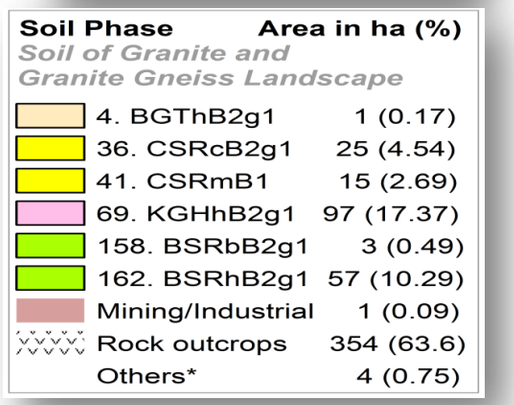
*Two legends accompany each map, a **map reference**, which depicts geographic features and a **thematic legend** which portrays spatial information. Picking up the symbol and colour of a particular enables one to go to the legends to obtain the required information.*



Soil Units

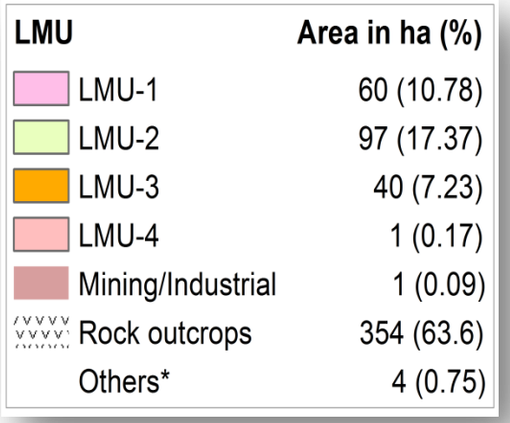
The soil map may be read at different levels. The most detailed level is that of the soil phase. Soil phases are distinguished within soil series mainly based on differences in surface of soil texture, slope, gravelliness , erosion ,etc.





Land Management Units (LMUs)

Grouping of similar soil areas based on their soil-site characteristics into land management units that respond similarly for a given level of management are designated as land management units.

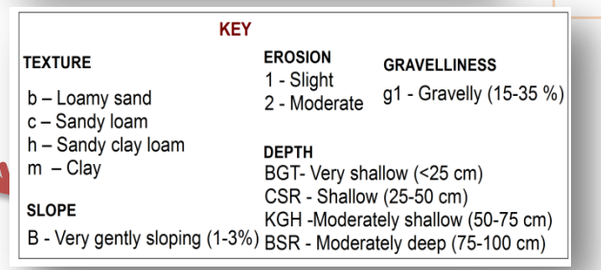


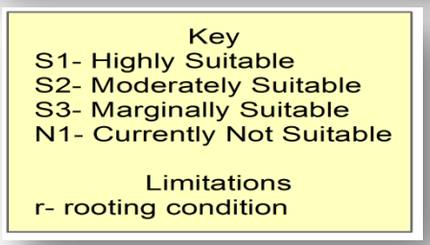
Map colours

Different shades of colours are used as an aid to distinguish the different classes of soils, crop suitability and other maps.

Map key

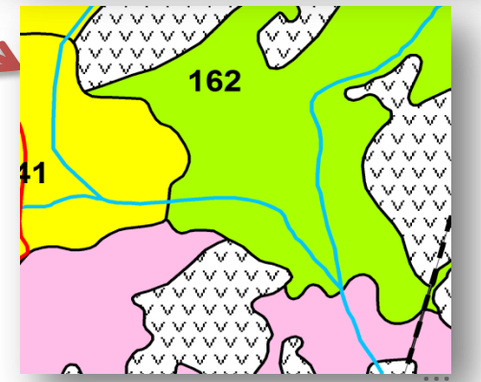
There are many thematic types to be differentiated on the map solely based on colour. Therefore soils and suitability types and their limitations are distinguished by colours with a combination of alpha-numeric characters.





Soil and plot boundaries

Soil units shown on the map are represented by both the color and a numeral. The soil boundaries are superimposed on land parcel with revenue survey number boundaries to visualize its spatial extent.



LAND RESOURCE INVENTORY OF HALE KUMTA SUB-WATERSHED FOR PLANNING KOPPAL TALUK, KOPPAL DISTRICT

A pilot study by ICAR-NBSS&LUP, Bangalore

INTRODUCTION

Land is a scarce resource and basic unit for any material production. It can support the needs of the growing population, provided they use land in a rational and judicious manner. But what is happening in many areas of the state is a cause for concern to anyone involved in the management of land resources at the grassroots level. In India the area available for agriculture is about 51 per cent of the total area and more than 60 per cent of the people are still relying on agriculture for their livelihood. The limited land area is under severe stress and strain due to increasing population pressure and competing demands of various land uses. Due to this, every year there is a significant diversion of farm lands and water resources for non-agricultural purposes. Apart from this, due to lack of interest for farming among the farmers in many areas, large tracts of cultivable lands are turning into fallows and this trend is continuing at an alarming rate.

The watershed management programs are aimed at designing suitable soil and water conservation measures, productivity enhancement of existing crops, crop diversification with horticultural species, greening the wastelands with forestry species of multiple uses and improving the livelihood opportunities for landless people.

The objectives can be met to a great extent when an appropriate Natural Resources Management (NRM) plan is prepared and implemented. It is essential to have site specific Land Resources Inventory (LRI) indicating the potentials and constraints for developing such a site specific plan. LRI can be obtained by carrying out detailed characterization and mapping of all the existing land resources like soils, climate, water, minerals and rocks, vegetation, crops, land use pattern, socio-economic conditions, infrastructure, marketing facilities and various schemes and developmental works of the government. From the data collected at farm level, the specific problems and potentials of the area can be identified and highlighted, conservation measures required for the area can be planned on a scientific footing, suitability of the area for various uses can be worked out and finally viable and sustainable land use options suitable for each and every land holding can be prescribed to the farmer and other land users of the area.

The Koppal district came to existence on 1st April 1998 by carving out of erst-while Raichur district of Karnataka with a geographical area of 552495 ha out of which forest area is 29451 ha, located in the northern part of the state. It lies between north latitudes 15˚09′ and 16˚ 01′ and east longitudes 75˚ 46′ and 76˚ 48′. The area falls in the Tungabhadra sub-basin of the Krishna basin. Tungabhadra river flows in the southern boundary of the district in north –easterly direction. The climate of the district is very hot and dry. The district has an average annual rainfall of 572 mm. Soils are well drained red sandy loam to medium deep black soils. This may be the weathering product of schistose, gneissic and granite terrain. Agriculture in Koppal district is dependent upon rainfall, irrigation tanks, wells, streams etc. The major agricultural crops grown are Jawar, Bajra, Wheat, Maize, Paddy, Horsegram, Greengram, Cowpea, Groundnut, Cotton, Niger seeds, Castor, Sunflower, Sugarcane etc. The major fruit crops include Pomegranates, Mango, Sapota, Citrus, Guava, Papaya. The major vegetable crops are leafy vegetables, Tomato, Onion, Brinjal etc.

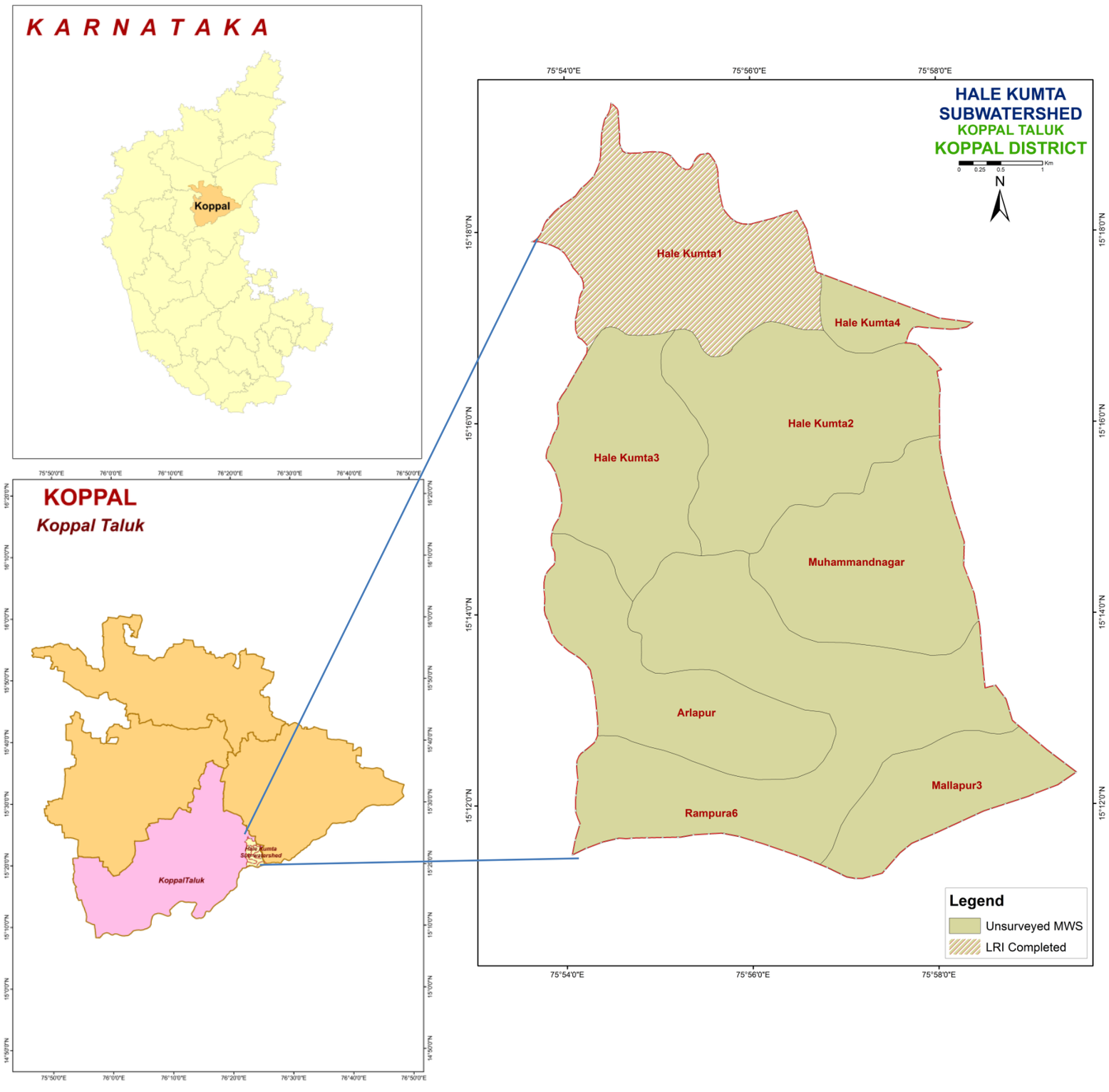
As a pilot study, **ICAR-NBSS&LUP, Bangalore** carried out the generation of LRI for the Hale Kumta Sub-watershed in Koppal taluk, Koppal district. It was selected for data base generation under Sujala III project. This sub-watershed encompasses of 10 MWs namely, Hale Kumta-1 (4D3A9G1b), Hale Kumta-2 (4D3A9G1c), Hale Kumta-3 (4D3A9G1d), Hale Kumta-4 (4D3A9G1a), Sanapura-1 (4D3A9G2e), Sanapura-2 (4D3A9G2f), Muhammandnagar (4D3A9G2b), Arlapur (4D3A9G2a), Rampura-6 (4D3A9G2c) and Mallapur-3 (4D3A9G2d) micro watersheds. Land Resource Inventory (LRI) was generated for one micro-watershed (Hale Kumta1 - 4D3A9G1b) among the ten micro-watersheds.

To be continued….

The major landforms identified in the micro-watershed (Hale Kumta1 - 4D3A9G1b) of Hale Kumta sub-watershed are uplands and low lands. The database was generated by using cadastral map of the village as a base along with high resolution satellite imagery (IRS LISS IV and Cartosat-1). The objectives of the land resource survey, carried out in the Hale Kumta 1 Micro-watershed covering an area of 556.19 ha are indicated below.

- Detailed characterization of all the land resources like soil, water, land use, cropping pattern and other resources available at parcel level in the village.
- Delineation of homogenous areas based on soil-site characteristics into management units.
- Collection and interpretation of climatic and agronomical data for crop planning.
- Identification of problems and potentials of the area and strategies for their management.
- Assessment of the suitability of land resources for various crops and other uses.
- Establishment of village level digital land resources database in a GIS framework.
- Enable the watershed and other line departments to prepare an action plan for the integrated development of the watershed.

LOCATION AND EXTENT OF HALE KUMTA SUB-WATERSHED



Hale Kumta sub-watershed (Koppal taluk, Koppal district) is located between $15^0$19'10''–$15^0$25'5'' North latitudes and $76^0$21'6''–76^0 26'37'' East longitudes, covering an area of about 5629 ha. Where, the Hale Kumta 1 Micro-watershed (Koppal taluk, Koppal district) is located in between 15^0 22' –15^0 24' North latitudes and 76^0 22' – 76^0 23' East longitudes, covering an area of about 556.19 ha. bounded by Kumara Ramanakunta & Chikkabenakalla villages.

Agro Ecological Region (AER) – 3: (Deccan plateau, hot arid ecosubregion)

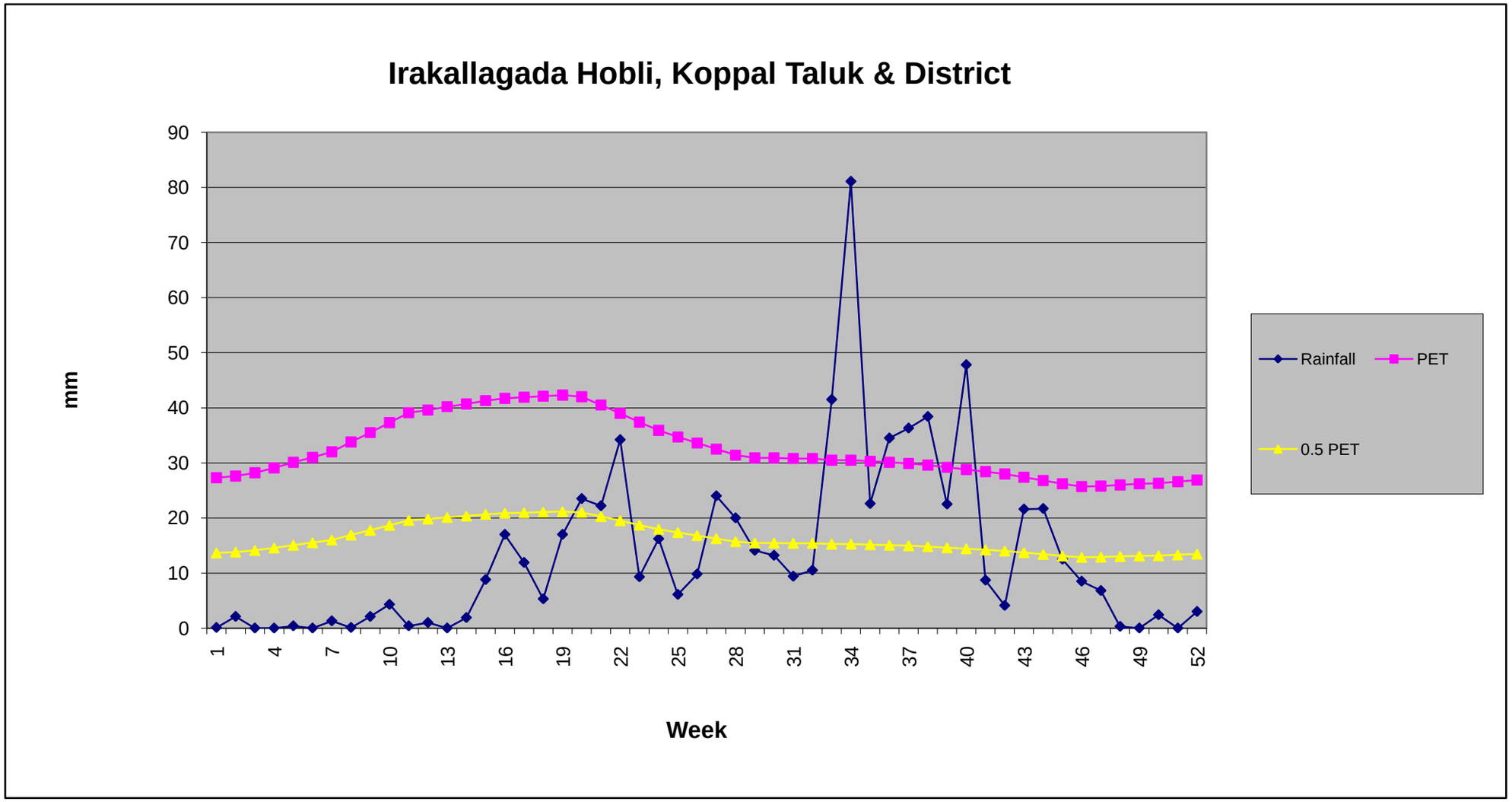
Karnataka Plateau (Rayalseema as inclusion), hot arid ESR with deep loamy and clayey mixed Red and Black soils, low to medium AWC and LGP 60-90 days.

Agro-climatic Zone 3: Northern Dry Zone:

This zone is the largest in the state with a geographical area of 5.04 M ha, of which about 3.55 M ha is under cultivation. Irrigation is available to about 0.49 M ha. The zone encompasses the entire districts of Bijapur and Bellary, 6 taluks of Koppal, 5 taluks of Dharwad and 5 taluks of Belgaum. Of the 35 taluks in the zone, 9 taluks have a mean elevation of 800-900 m MSL while the rest have an elevation of 450-800 m. The rainfall is similar to that of the northeastern dry zone, ranging between 465 and 785 mm. Black soils are predominant in the zone with depth ranging from shallow to deep. General cropping season is *kharif* in shallow black soils and *rabi* in medium and deep black soils. Important crops of the zone are jowar, maize, bajra, groundnut, pulses, sunflower, cotton and sugarcane.

NOTE: In this Sub-Watershed, Land Resource Inventory (LRI) was generated for one micro-watershed (Hale Kumta1 - 4D3A9G1b) among the ten micro-watersheds.

Climate

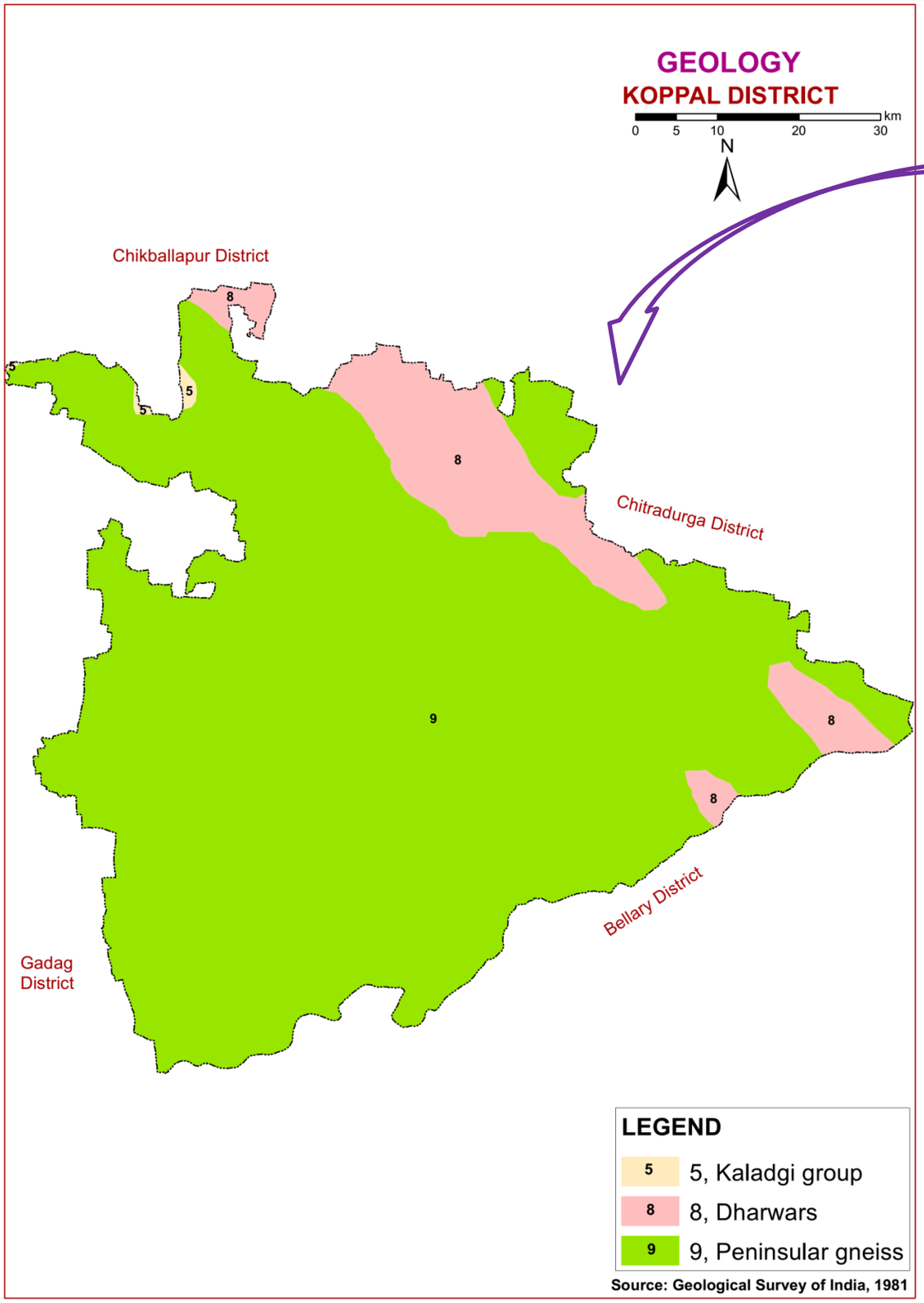


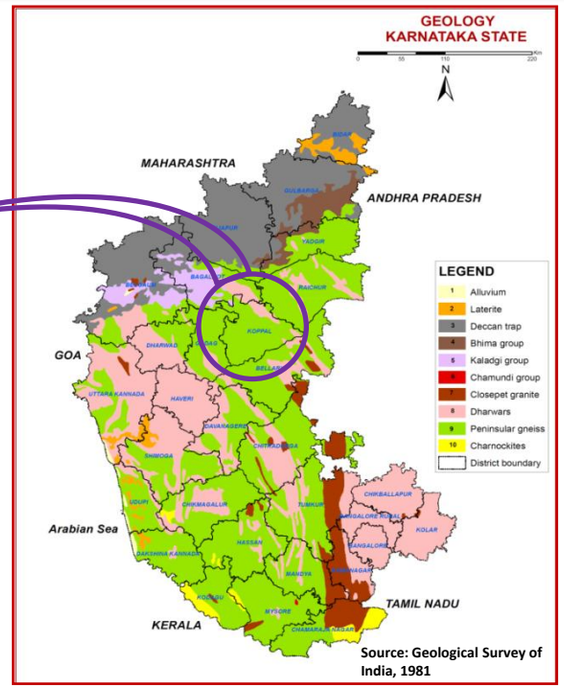
Length of Growing Period (LGP) is varying from July 1st week to last week of September (< 90 days)

Annual Rainfall : 701 mm. in the Irakallagada Hobli, Koppal Taluk & District

Source: KSNMDC (1980-2011)

Geology





GEOLOGY - KARNATAKA STATE

Karnataka forms part of the Peninsular Shield, which is an ancient stable block of the earth's crust. The shield is composed of geologically ancient rocks of diverse origin. These rocks have undergone various degrees of metamorphism and crushing. Overlying these ancient rocks are Proterozoic, lete Creteceous to Palaeocene, Palaeocene to Recent, and Recent sediments.

In the stratigraphic succession of rocks in Karnataka the Archaean group is the oldest, followed by Proterozoic, Mesozoic and Cainozoic formations.

GEOLOGY - KOPPAL DISTRICT

Kaladgi group

It consists of nearly horizontal sedimentary rocks 3000 to 5000m thick overlying the Archaeans. The component rocks are sandstones, shales, limestone, dolomite and schists.

Dharwar schists

The Dharwar schists consist of a complex series of crystalline schists associated with ultrabasic rocks such as amphibolite, peridotites and dunites. These schists are found in long, narrow bands of various dimensions running NW-SE through the Peninsular Gneiss. The Dharwars are divided into Upper and Lower.

Upper Dharwars are equivalent to the Archaean to Lower Proterozoic, and are divided into Bababudan (comprises banded ferruginous quartzites, pyroxenite, gabbro, serpentinite, acid volcanic, phyllites, metabasalt, and quartz-chlorite schist) and Chitradurga groups (includes quartzite, limestone, dolomite, chlorite-schist, and manganese and iron ores with phyllite, metabasalt and conglomerates).

Lower Dharwars occur in Mysore district and include amphibolite schist, quartzite, ironstone and marble.

Peninsular Gneiss

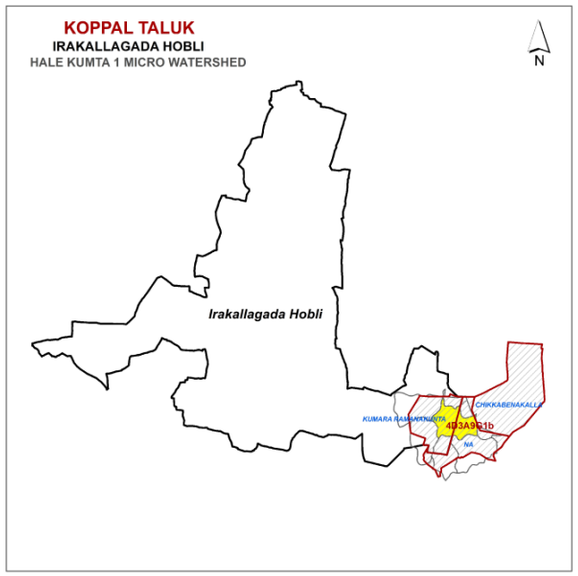
Exposed over a large area of Karnataka in all the districts except Bidar is the Peninsular Gneiss which is a heterogeneous mixture of several types of granitic rocks such as banded gneisses, granitic gneisses, granites and gneissic granites, granodiorites and diorites. The banded gneisses consist of white bands of quartz-feldspar alternating with dark bands of biotite, hornblende, and minor accessories. The granite group includes granites of all shades with varying composition. Peninsular gneiss seems to have formed by the granitization of the older rocks.

SURVEY METHODOLOGY
Sequence of activities in generation of LRI

- Traversing the watershed using cadastral maps and imagery as base
- Identifying landforms, geology, land use and other features
- Selecting fields representing land units
- Opening profiles to 2 m depth
- Studying soil and site characteristics
- Grouping similar areas based on their soil-site characteristics into land management units
- Preparation of crop, soil and water conservation plan
- Socio-economic evaluation

The required site and soil characteristics are described and recorded on a standard proforma by following the protocols and guidelines given in the soil survey manual and field guide. Collection of soil samples from representative pedons for laboratory characterization and collection of surface soil samples from selected fields covering most of the management units for macro and Micro-nutrient analysis is being carried out (320m grid intervals). Further processing of data at chemical lab and GIS lab are carried out to generate various thematic maps for each of the study area.

3.1. Database Used - Cadastral map



Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

km
0 0.25 0.5 1

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

NA

NA

NA

2 3 1 17 4 16 11 36

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

3.2. Database Used - Satellite Image

SATELLITE IMAGE

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

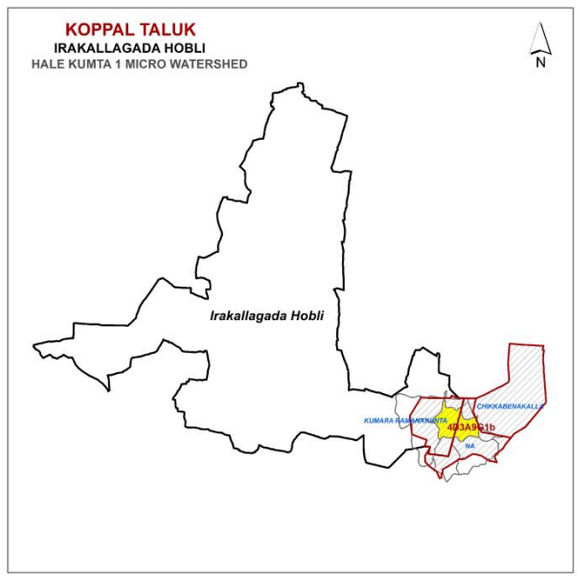
NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- Land parcels
- Village boundary
- Micro-watershed boundary

Source: Cartosat 1 Imagery, 2011

3.3. Current Land Use



CURRENT LANDUSE (2018)

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

km
0 0.25 0.5 1
N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla 36

2
3
1 NA
4
16
17
11

Dy+Jw+Pm+Pd+Rg+Bj+Cf+Fl+Mz+Gn

NA

NA

Dy+Pd+Mz+Gn+Rg

NA

References

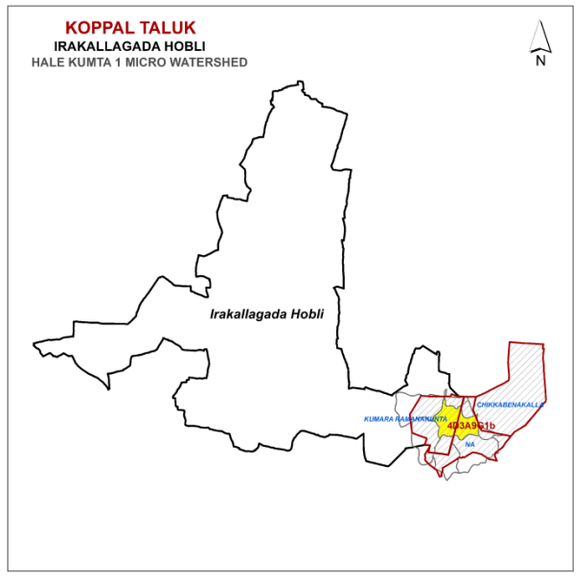
- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Current LandUse

- Dyke+Paddy+Maize+Groundnut+Redgram (Dy+Pd+Mz+Gn+Rg)
- Dyke+Jowar+Pearl Millet+Paddy+Redgram+Bajra+Current Fallow+Fallow Land+Maize+Groundnut (Dy+Jw+Pm+Pd+Rg+Bj+Cf+Fl+Mz+Gn)
- Not Available (NA)

Source: ICAR-NBSS&LUP, Bengaluru

3.4. Location of Wells



LOCATION OF WELLS

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

km
0 0.25 0.5 1
N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

NA

NA

NA

2 3 1 17 4 16 11 36

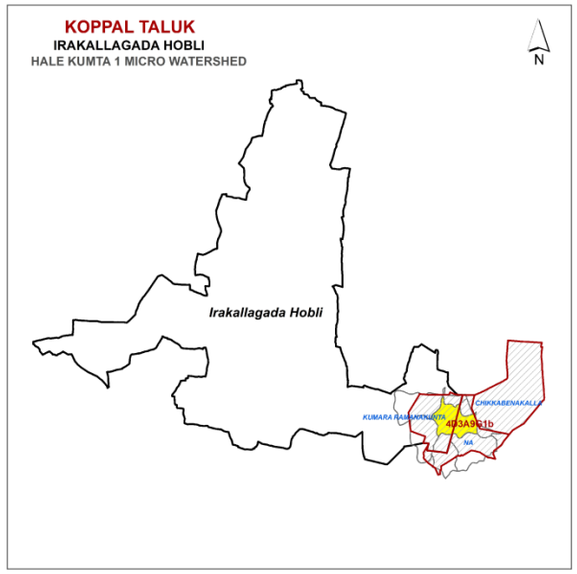
References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Legend	No's
Borewell	9
Openwell	2

Source: ICAR-NBSS&LUP, Bengaluru

4. The Soils



SOILS

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

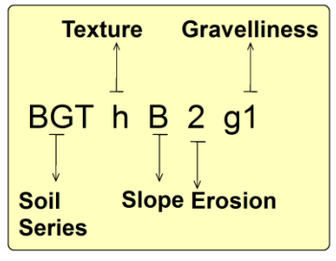
Chikkabenakalla

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Soil Phase	Area in ha (%)
Soil of Granite and Granite Gneiss Landscape	
4. BGThB2g1	1 (0.17)
36. CSRcB2g1	25 (4.54)
41. CSRmB1	15 (2.69)
69. KGHhB2g1	97 (17.37)
158. BSRbB2g1	3 (0.49)
162. BSRhB2g1	57 (10.29)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation



KEY

TEXTURE
b – Loamy sand
c – Sandy loam
h – Sandy clay loam
m – Clay

SLOPE
B - Very gently sloping (1-3%)

EROSION
1 - Slight
2 - Moderate

GRAVELLINESS
g1 - Gravelly (15-35 %)

DEPTH
BGT- Very shallow (<25 cm)
CSR - Shallow (25-50 cm)
KGH -Moderately shallow (50-75 cm)
BSR - Moderately deep (75-100 cm)

Source: ICAR-NBSS&LUP, Bengaluru

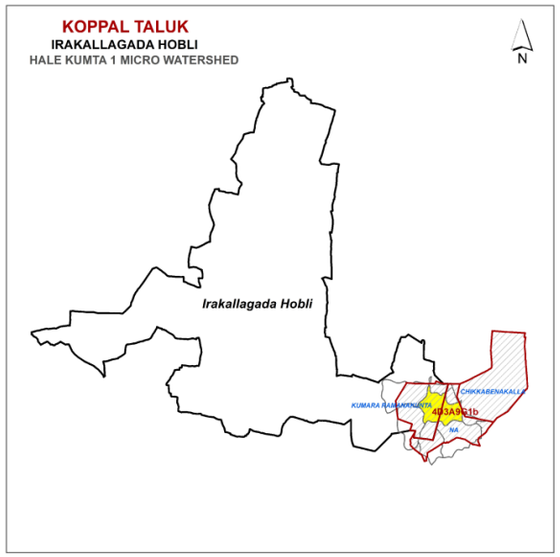
Mapping unit description of Hale Kumta 1 Micro-watershed in Koppal taluk, Koppal district

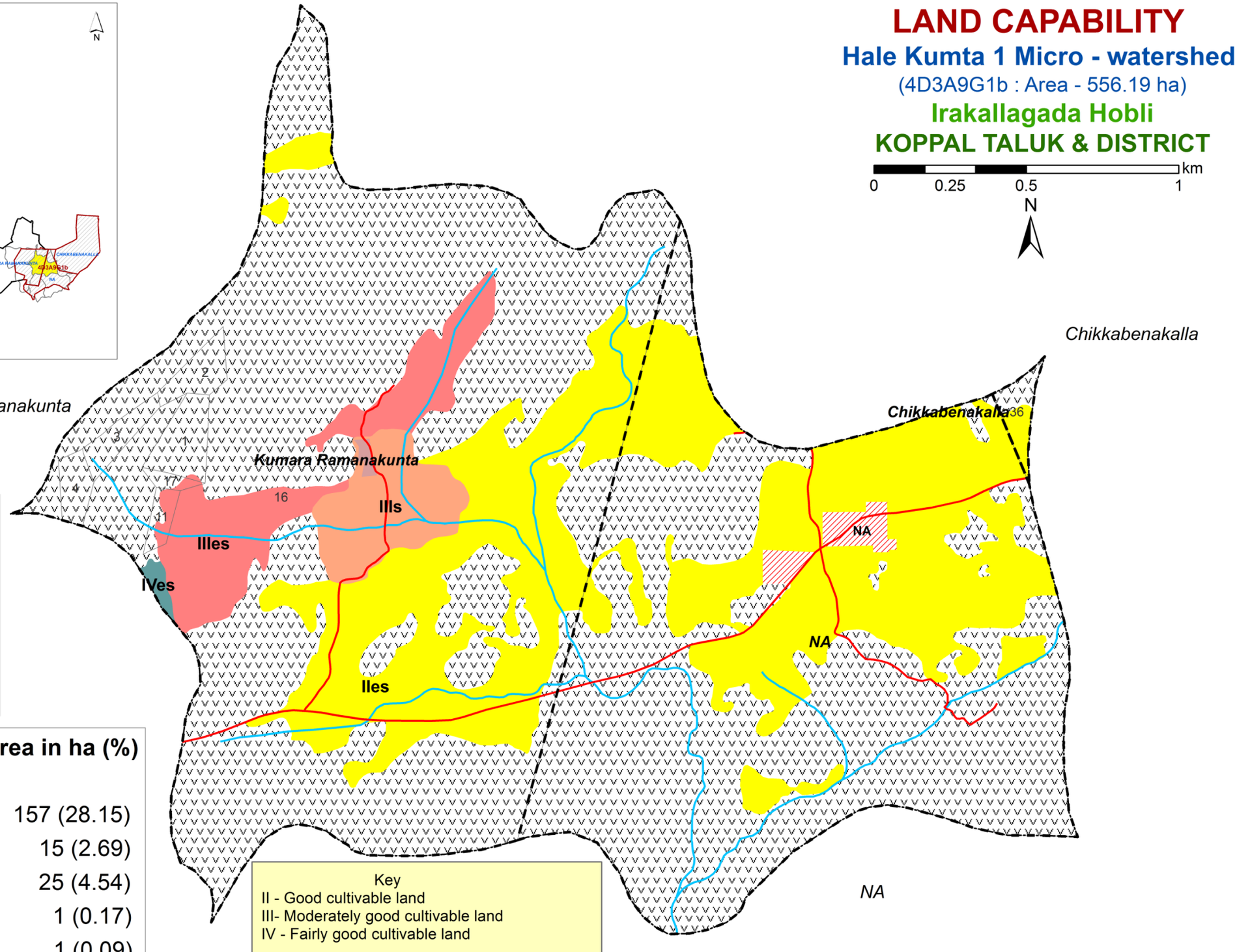
Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite gneiss Landscape				
	BGT	Belagatti soils are very shallow (< 25 cm), well drained, have very dark gray to very dark grayish brown, calcareous gravelly black clay soils occurring on very gently to gently sloping uplands under cultivation		**1 (0.17)**
4		BGThB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	1 (0.17)
	CSR	Chikkasavanur soils are shallow (25-50 cm), well drained, have dark brown to light yellowish brown, sandy clay loam soils occurring on nearly level to very gently sloping uplands under cultivation		**40 (7.23)**
36		CSRcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	25 (4.54)
41		CSRmB1	Clay surface, slope 1-3%, slight erosion	15 (2.69)
	KGH	Kutegoudanahundi soils are moderately shallow (50-75 cm), well drained, have brown to dark brown gravelly red sandy clay loam soils occurring on nearly level to very gently to gently sloping uplands under cultivation		**97 (17.37)**
69		KGHhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	97 (17.37)
	BSR	Bisarahalli soils are moderately deep (75-100 cm), well drained, have dark reddish brown red gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**60 (10.78)**
158		BSRbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	3 (0.49)
162		BSRhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	57 (10.29)
994		Mining/Industrial	Mining/Industrial area	**1 (0.09)**
999		Rock outcrops	Rock lands, both massive & bouldery with little or no soil	**354 (63.6)**
1000		Others	Habitation	**4 (0.75)**

*Soil map unit numbers are continuous for the taluk, not the micro-watersheds

5. Soil Survey Interpretations

5.1. Land Capability Classification





5.2. Soil Depth

SOIL DEPTH

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Chikkabenakalla

Kumara Ramanakunta

NA

NA

NA

References

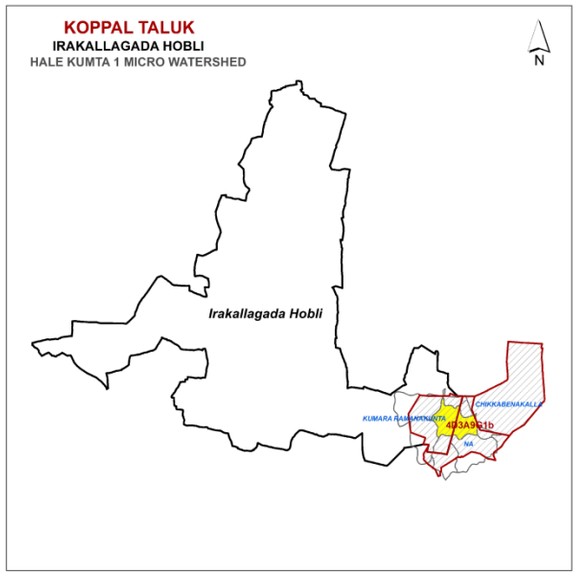
- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Depth Class	Area in ha (%)
Very shallow (<25 cm)	1 (0.17)
Shallow (25-50 cm)	40 (7.23)
Moderately shallow (50-75 cm)	97 (17.37)
Moderately deep (75-100 cm)	60 (10.78)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Source: ICAR-NBSS&LUP, Bengaluru

5.3. Surface Soil Texture



SURFACE SOIL TEXTURE

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 — Land parcel with No's
- Village boundary
- Micro-watershed boundary

Texture Class	Area in ha(%)
Loamy sand	3 (0.49)
Sandy loam	25 (4.54)
Sandy clay loam	155 (27.84)
Clay	15 (2.69)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Source: ICAR-NBSS&LUP, Bengaluru

5.4. Surface Soil Gravelliness

Kumara Ramanakunta

SOIL GRAVELLINESS

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Chikkabenakalla

Chikkabenakalla

Kumara Ramanakunta

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Gravelly Class	Area in ha (%)
Non gravelly (<15%)	15 (2.69)
Gravelly (15-35%)	183 (32.86)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Source: ICAR-NBSS&LUP, Bengaluru

5.5. Available Water Capacity

AVAILABLE WATER CAPACITY

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

km
0 0.25 0.5 1
N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

NA

NA

NA

References

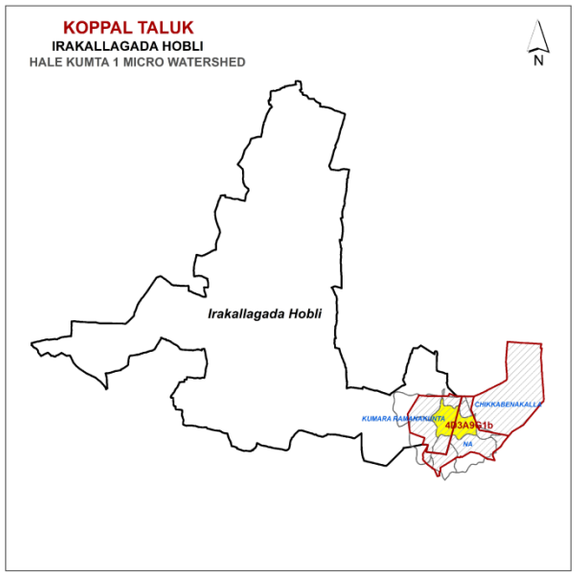
- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Available Water Capacity	Area in ha (%)
Very Low (<50 mm/m)	41 (7.4)
Low (51-100 mm/m)	157 (28.15)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Source: ICAR-NBSS&LUP, Bengaluru

5.6.Slope



SLOPE

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla 36

NA

NA

NA

References

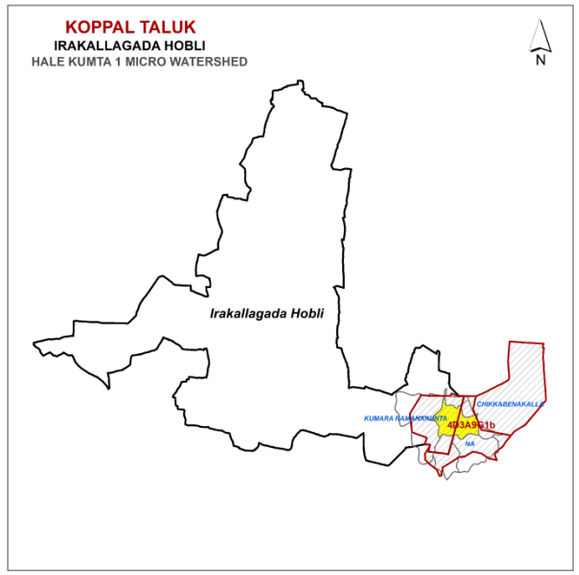
- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Slope Class	Area in ha (%)
Very gently sloping (1-3%)	198 (35.55)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Source: ICAR-NBSS&LUP, Bengaluru

5.7.Soil Erosion



Kumara Ramanakunta

SOIL EROSION

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Chikkabenakalla

Chikkabenakalla

Kumara Ramanakunta

NA

NA

NA

References

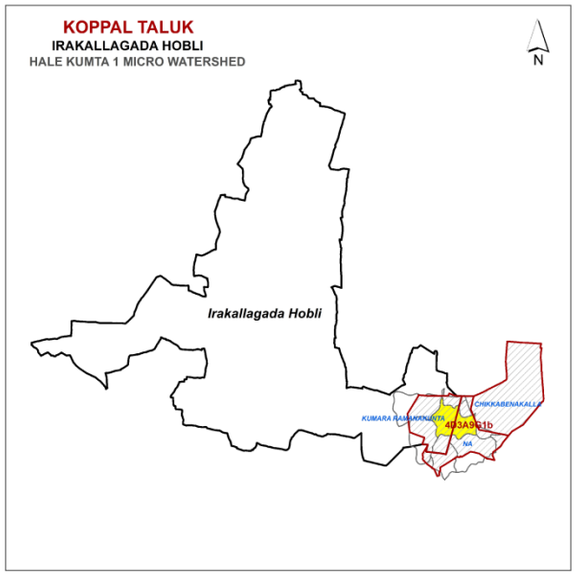
- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Erosion Class	Area in ha(%)
Slight	15 (2.69)
Moderate	183 (32.86)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Source: ICAR-NBSS&LUP, Bengaluru

6.1. Soil Reaction (pH)



SOIL REACTION (pH) (2018)

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

km
0 0.25 0.5 1
N

Kumara Ramanakunta

Chikkabenakalla

References

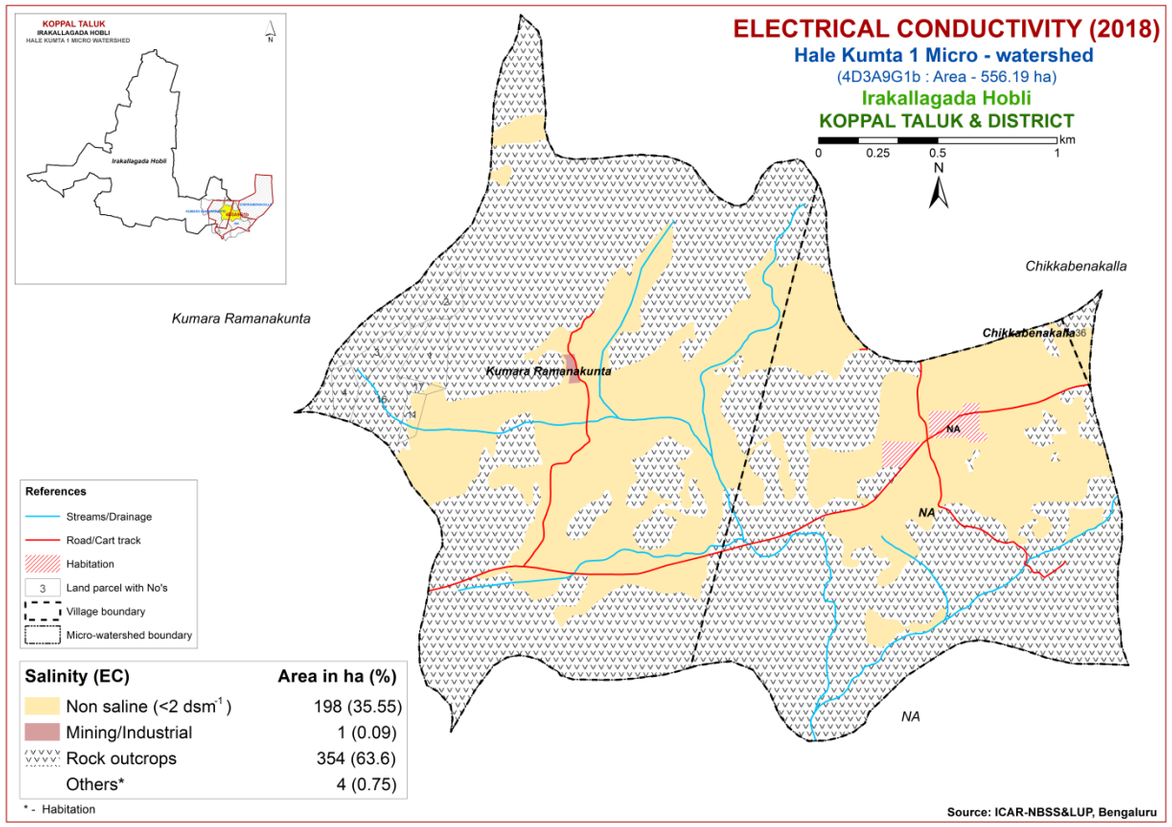
- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Reaction Class	Area in ha (%)
Slightly acid (pH 6.0 – 6.5)	10 (1.75)
Neutral (pH 6.5 – 7.3)	74 (13.34)
Slightly alkaline (pH 7.3 – 7.8)	72 (12.98)
Moderately alkaline (pH 7.8 – 8.4)	35 (6.37)
Strongly alkaline (pH 8.4 – 9.0)	6 (1.12)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

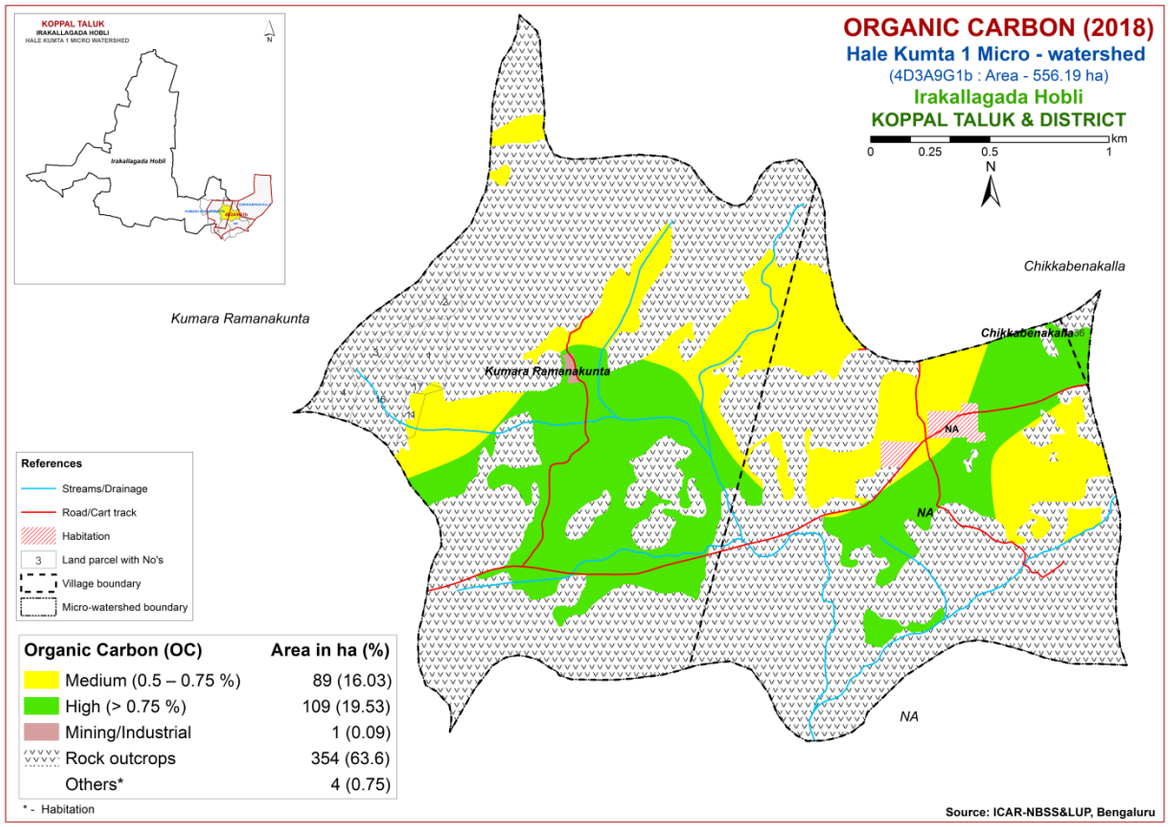
* - Habitation

Source: ICAR-NBSS&LUP, Bengaluru

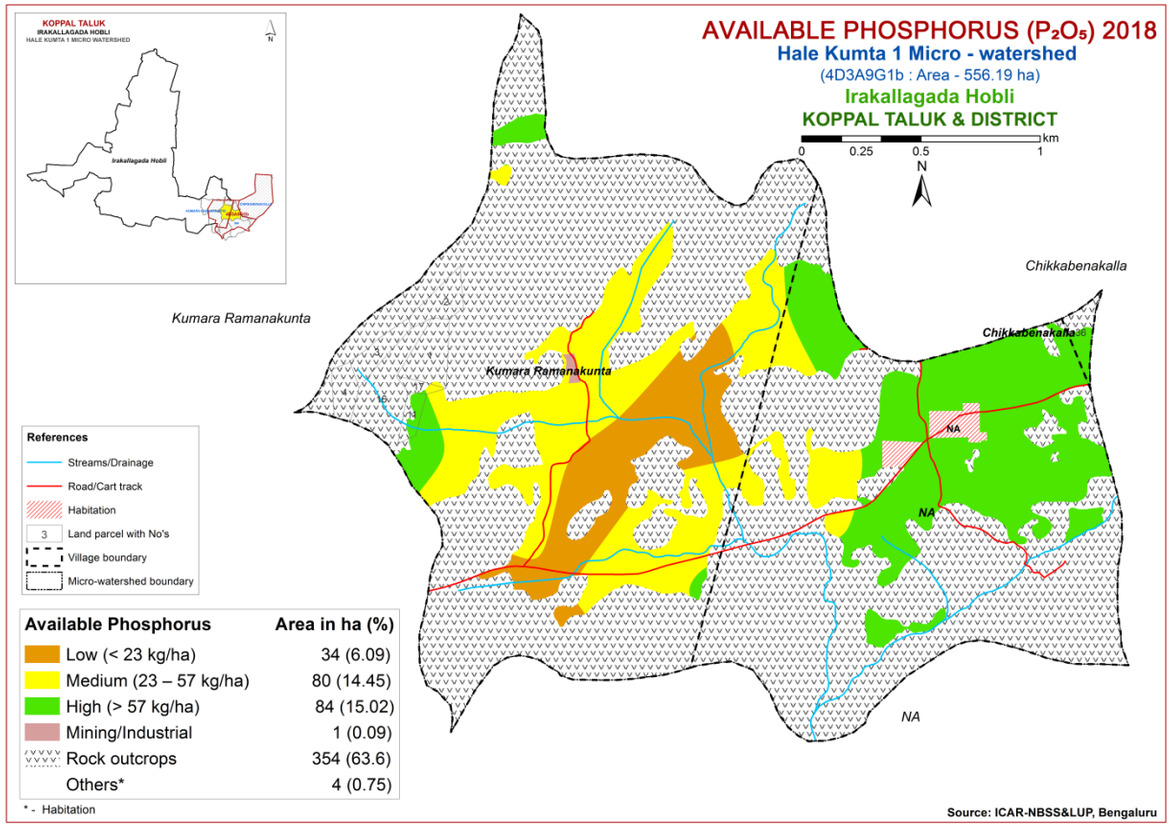
6.2. Electrical Conductivity (EC)



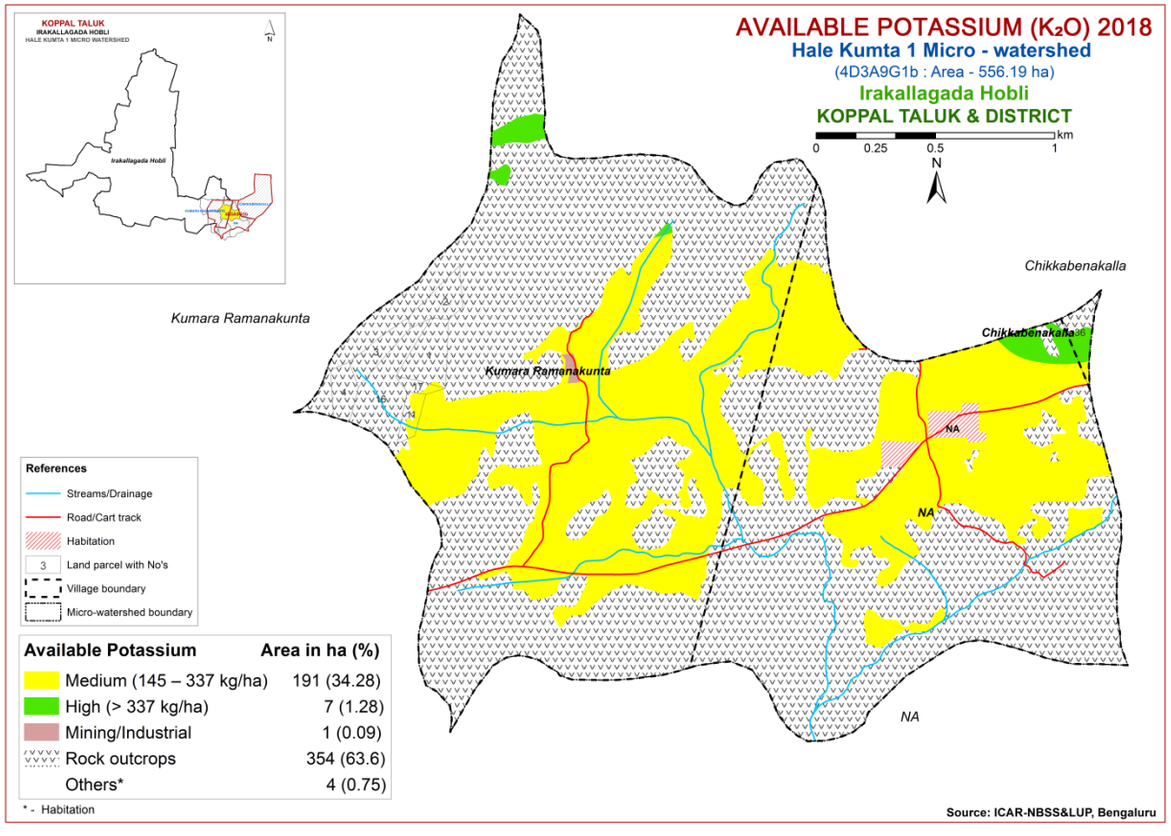
6.3. Organic Carbon



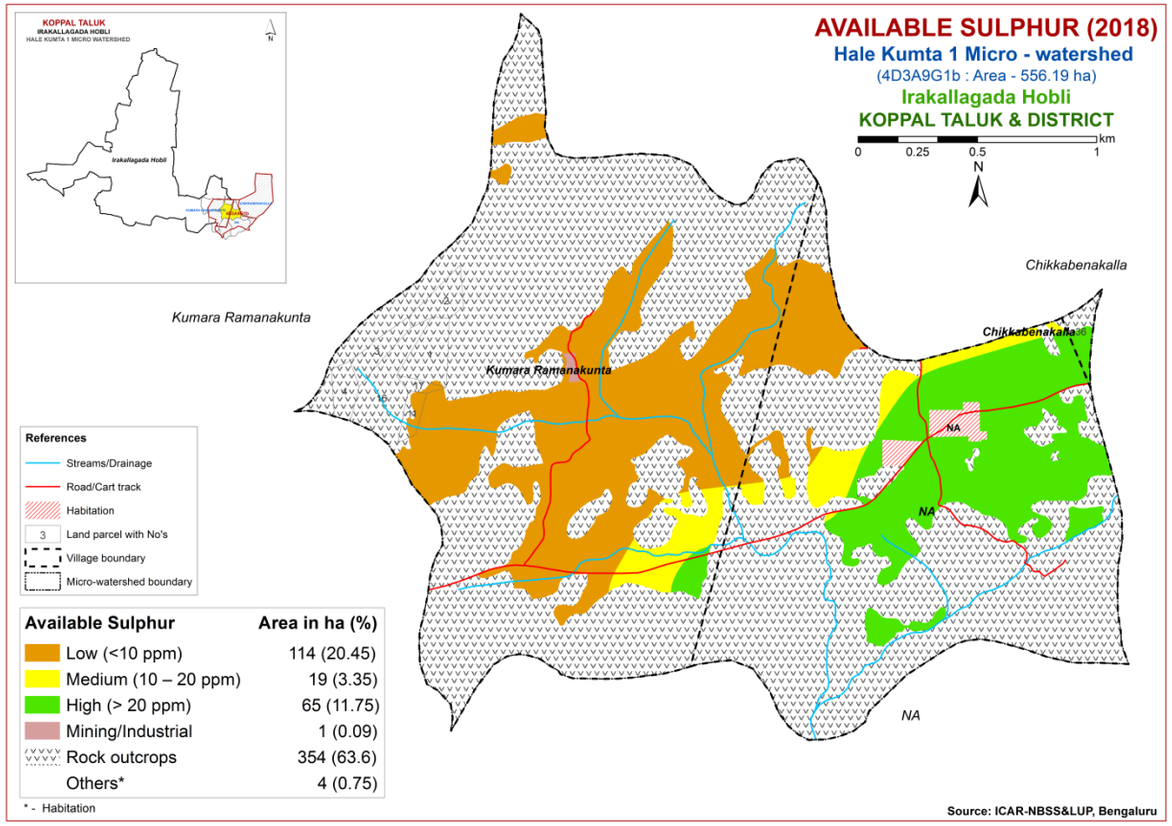
6.4. Available Phosphorus (P_2O_5)



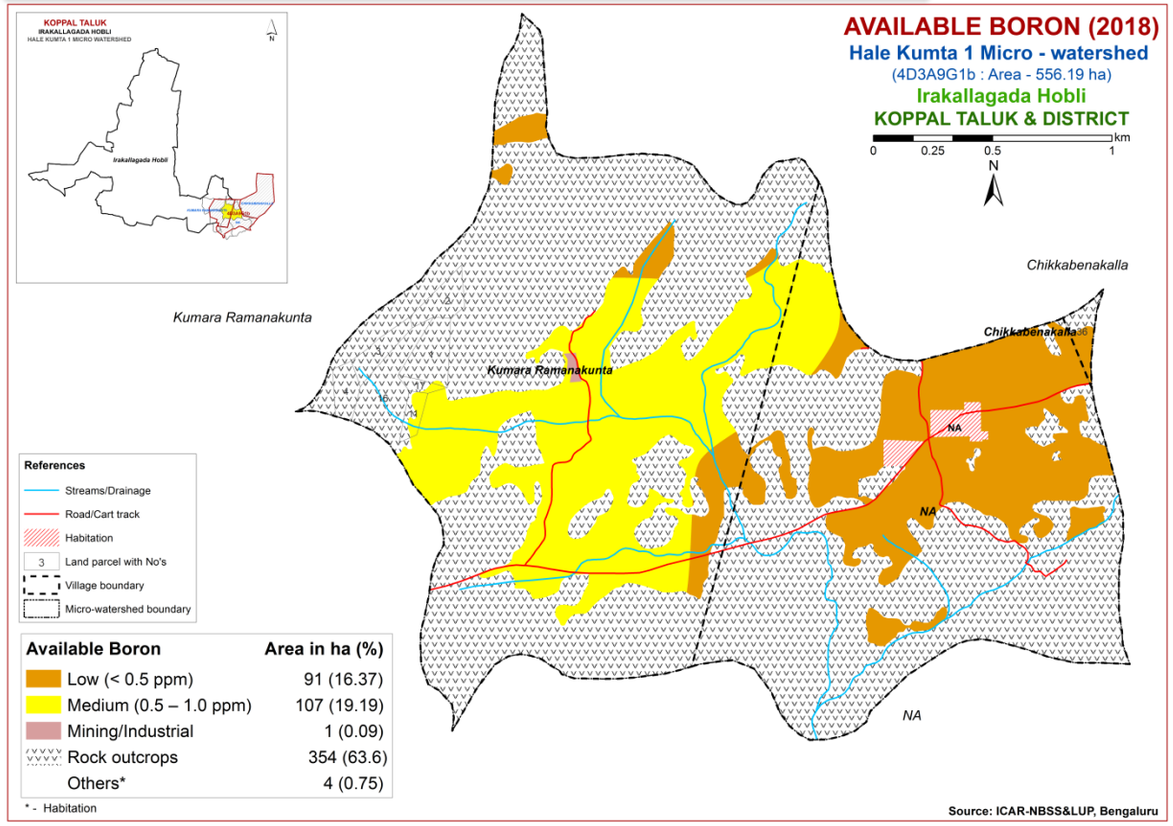
6.5. Available Potassium (K_2O)



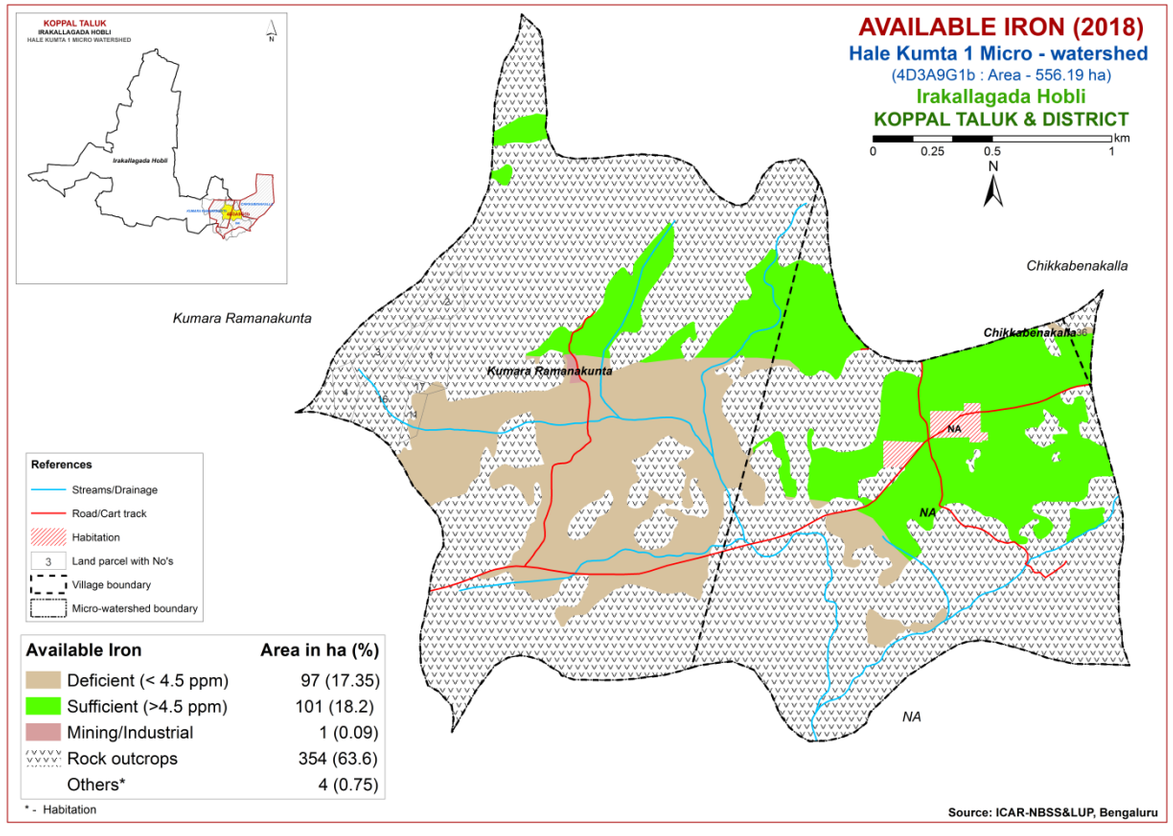
6.6. Available Sulphur



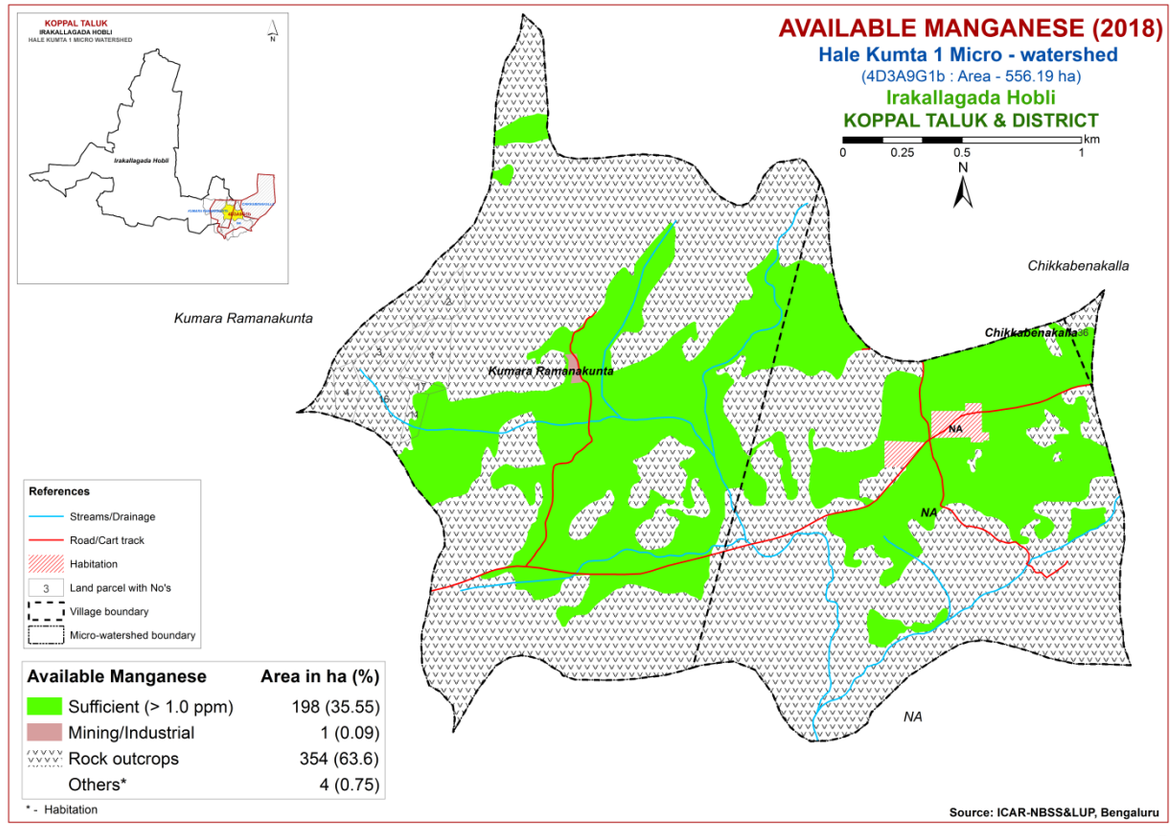
6.7. Available Boron



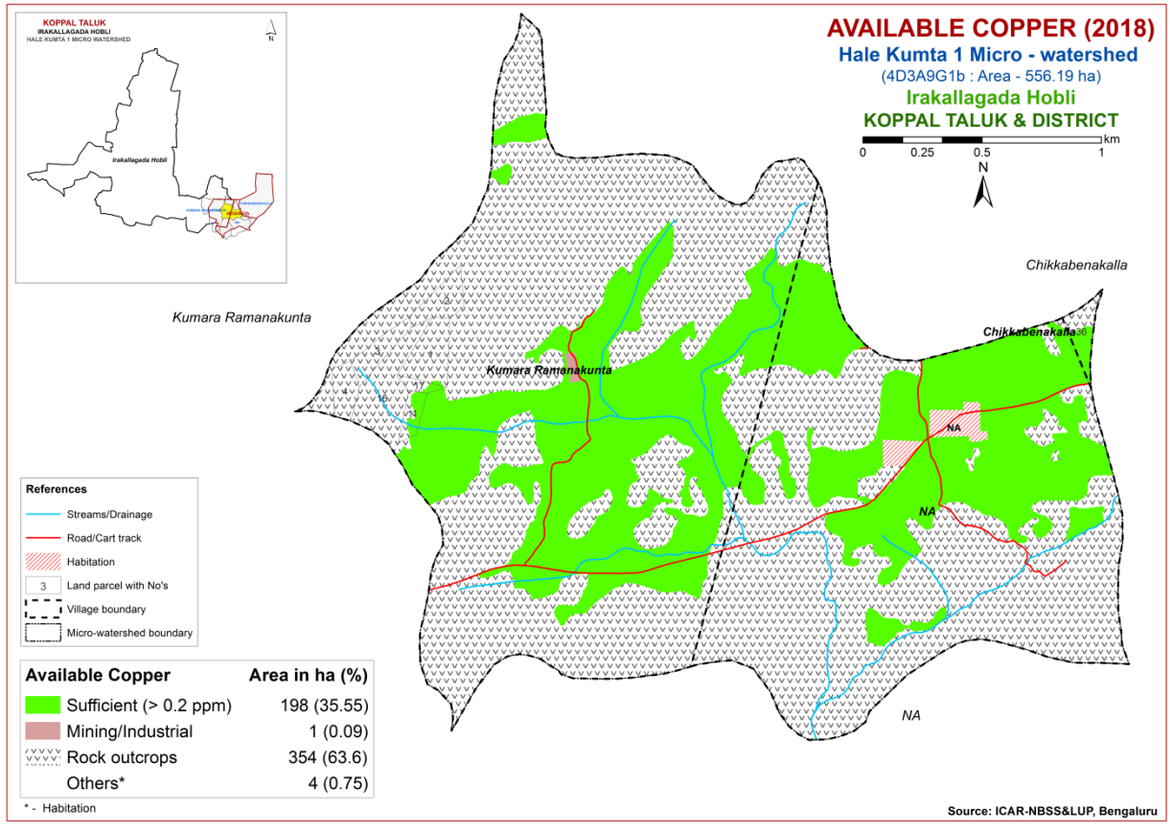
6.8. Available Iron



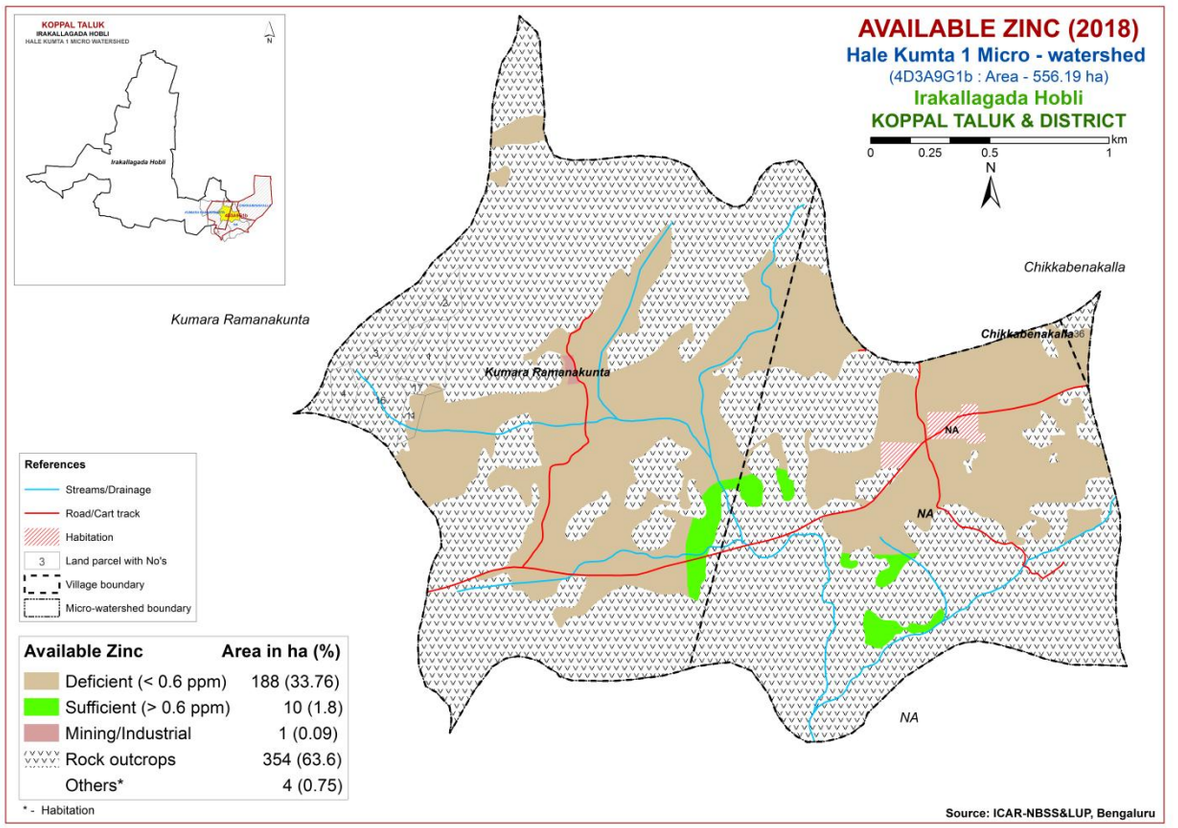
6.9. Available Manganese



6.10. Available Copper



6.11. Available Zinc



6.12. Correcting the Soil Nutrient Deficiencies

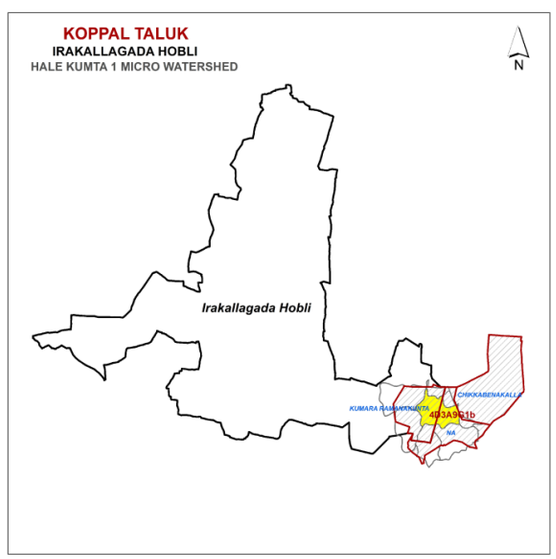
1. Reclamation of Salt affected soils
   a) When the soil is having neutral pH (6.5-7.5), no need of adding amendments (lime or gypsum)
   b) If the soil pH is <6.5, apply burnt lime to soil as per specifically recommended dosage and again after 2 years proper change has to be made based on soil test results.
   c) If the soil pH is 7.5-8.5 due to excess calcium content, drain out the excess calcium form the soil with good quality irrigation water.
   d) If the soil pH is more than 8.5 due to higher sodium content in soil, apply specifically recommended dose of gypsum & drain out the excess salts with good quality irrigation water.

2. In case of low & high content of major nutrients in the soil, follow the modifications as given bellow:
   - N: P: K (N: P_2O_5: K_2O) **For low N content**, add 25 % extra to the Recommended Dose of Fertilisers (RDF).
     For high N content, reduce 25% from the RDF and apply to soil.
     Eg:- if 100kg N, then we have to apply
     100+25% for deficient soil.
     100% for medium available N content soil.
     100-25% for higher N content soil.
   - Follow the same in case of P & K.

3. Use or Incorporation of biofertilizers like Rhizobium, Azotobacter, Azospirillum, Phosphate Solubilizing Bacteria and mycorrhiza enhances normal available nutrients in soil to the plants and also reduce the input cost of cultivation.
4. For calcium deficient soil, apply N-fertilizers like calcium ammonium nitrate; Gypsum can also supply calcium ($CaSO_4.2H_2O$)
5. Apply 405kg $MgSO_4$ per ha to the magnesium deficient soil. In case of perennial horticulture crops apply 150-200g/ plant.
6. In sulphur deficient acid soils (Humid region) apply phosphorus (in the form of) through SSP & use sulphur coated urea to the crops.
7. Apply 30-50kg ferrous sulfate ($FeSO_4$) per ha to the iron deficient soils. In case of perennial Horticulture crops apply 3-5g/ litre $FeSo_4$ /plant as foliar spray.
8. Apply 30-40kg/ha – manganese sulfate ($MnSO_4$) as soil application to the manganese deficient soils. In case of perennial Horticulture crops apply 3-5 g/litre $MnSO_4$ /plant as foilar application.
9. Apply Zinc – 10-25 kg/ha –$ZnSO_4$ – soil application to the Zinc deficient soils. In case of perennial Horticulture crops apply 3-5g/ litre – foliar application.
10. Apply Copper – 5-10 kg /ha – copper sulfate ($CuSO_4$) soil application for the copper deficient soils and for Perennial horticultural crops 3-5g/ litre – $CuSO_4$/plant as foliar application.
11. Apply borax 8-10 kg/ha in boron deficient soils and for Perennial horticultural crops as foliar application – 1g / litre.
12. Apply molybdenum – ammonium molybdate 200-250 gm/ha for Molybdenum deficient soils or dissolve 1g / litre ammonium molybdate for Foliar spray.
13. Soil sampling and testing needs to be done at every 2-3 years interval.

7. Land Suitability for Major Crops

7.1. Land Suitability for Sorghum



LAND SUITABILITY FOR SORGHUM

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

S2g

S3r

S2rt

N1r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2rt	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition
t- texture

Source: ICAR-NBSS&LUP, Bengaluru

7.2. Land Suitability for Maize

LAND SUITABILITY FOR MAIZE

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

S2g

S3r

S2r

N1r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

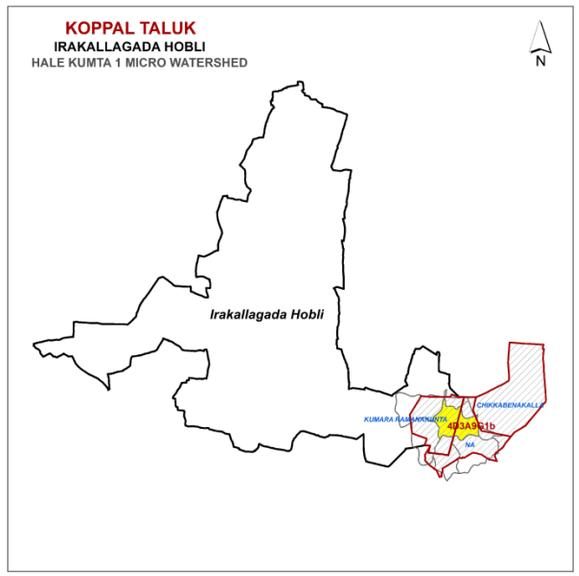
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.3. Land Suitability for Redgram



LAND SUITABILITY FOR REDGRAM

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

S2rg

N1r

S3r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2rg	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

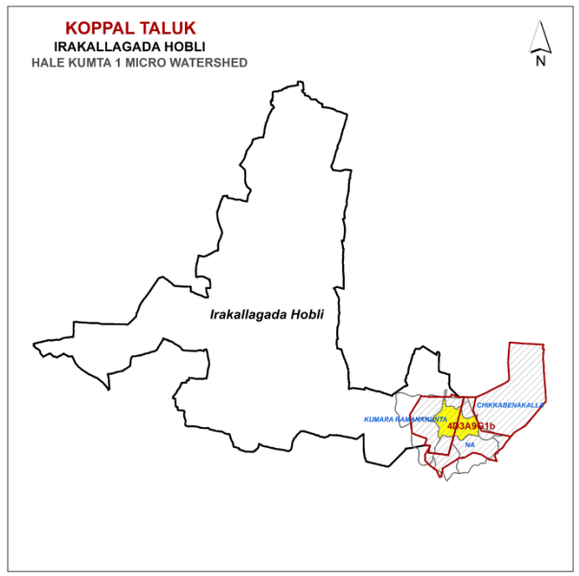
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.4. Land Suitability for Bajra



LAND SUITABILITY FOR BAJRA

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

NA

NA

S1

S3r

S2r

N1r

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S1	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

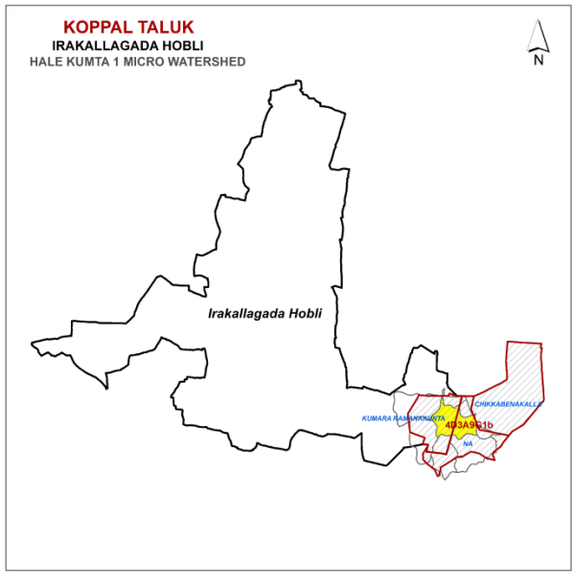
* - Habitation

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.5. Land Suitability for Drumstick



LAND SUITABILITY FOR DRUMSTICK

Hale Kumta 1 Micro - watershed

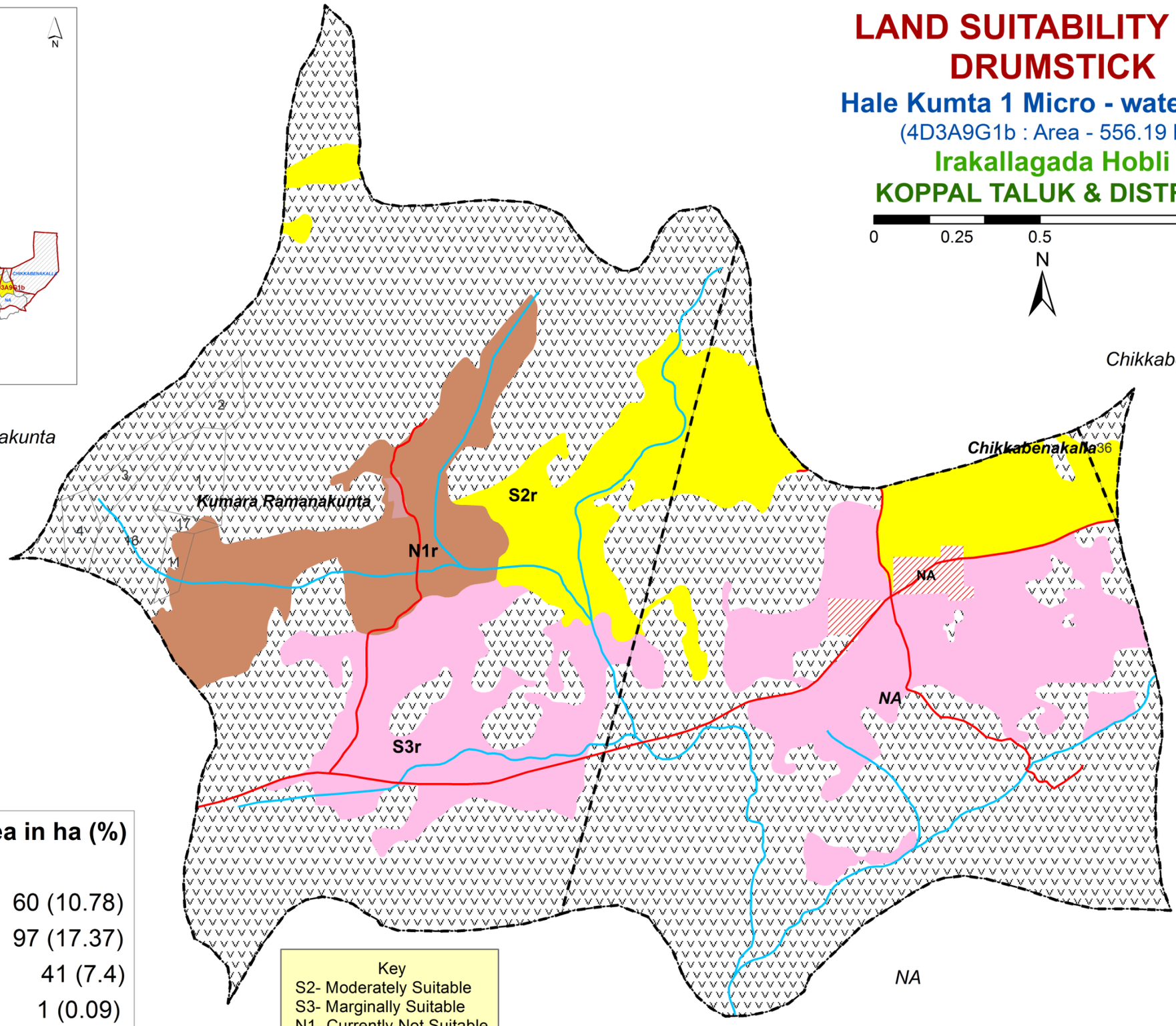
(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N



References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2r	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

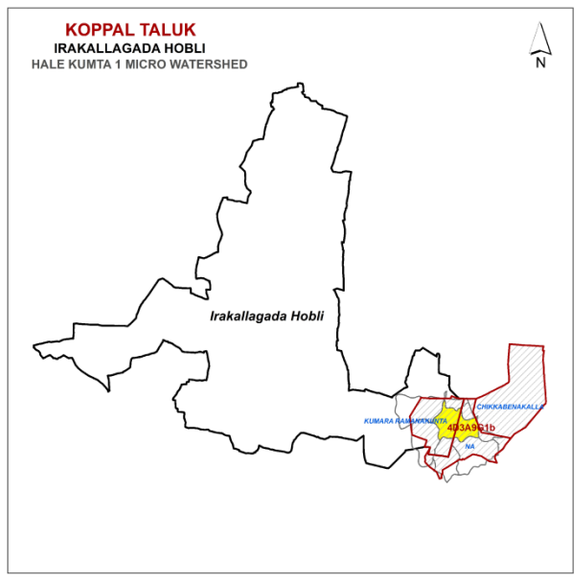
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.6. Land Suitability for Sunflower



LAND SUITABILITY FOR SUNFLOWER

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

S2rg

N1r

S3r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2rg	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.7. Land Suitability for Cotton

LAND SUITABILITY FOR COTTON

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

NA

NA

NA

S2rg

S3rt

S3t

N1r

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2rg	60 (10.78)
S3t	97 (17.37)
S3rt	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition
t- texture

Source: ICAR-NBSS&LUP, Bengaluru

7.8. Land Suitability for Bengalgram

LAND SUITABILITY FOR BENGALGRAM

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Chikkabenakalla 36

Kumara Ramanakunta

S3rt

N1r

S3t

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S3t	157 (28.15)
S3rt	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
r- rooting condition
t- texture

Source: ICAR-NBSS&LUP, Bengaluru

7.9. Land Suitability for Groundnut

LAND SUITABILITY FOR GROUNDNUT

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Chikkabenakalla 36

Kumara Ramanakunta

S2t

S3r

N1r

S2r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 — Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2r	97 (17.37)
S2t	60 (10.78)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
r- rooting condition
t- texture

Source: ICAR-NBSS&LUP, Bengaluru

7.10. Land Suitability for Chilli

LAND SUITABILITY FOR CHILLI

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

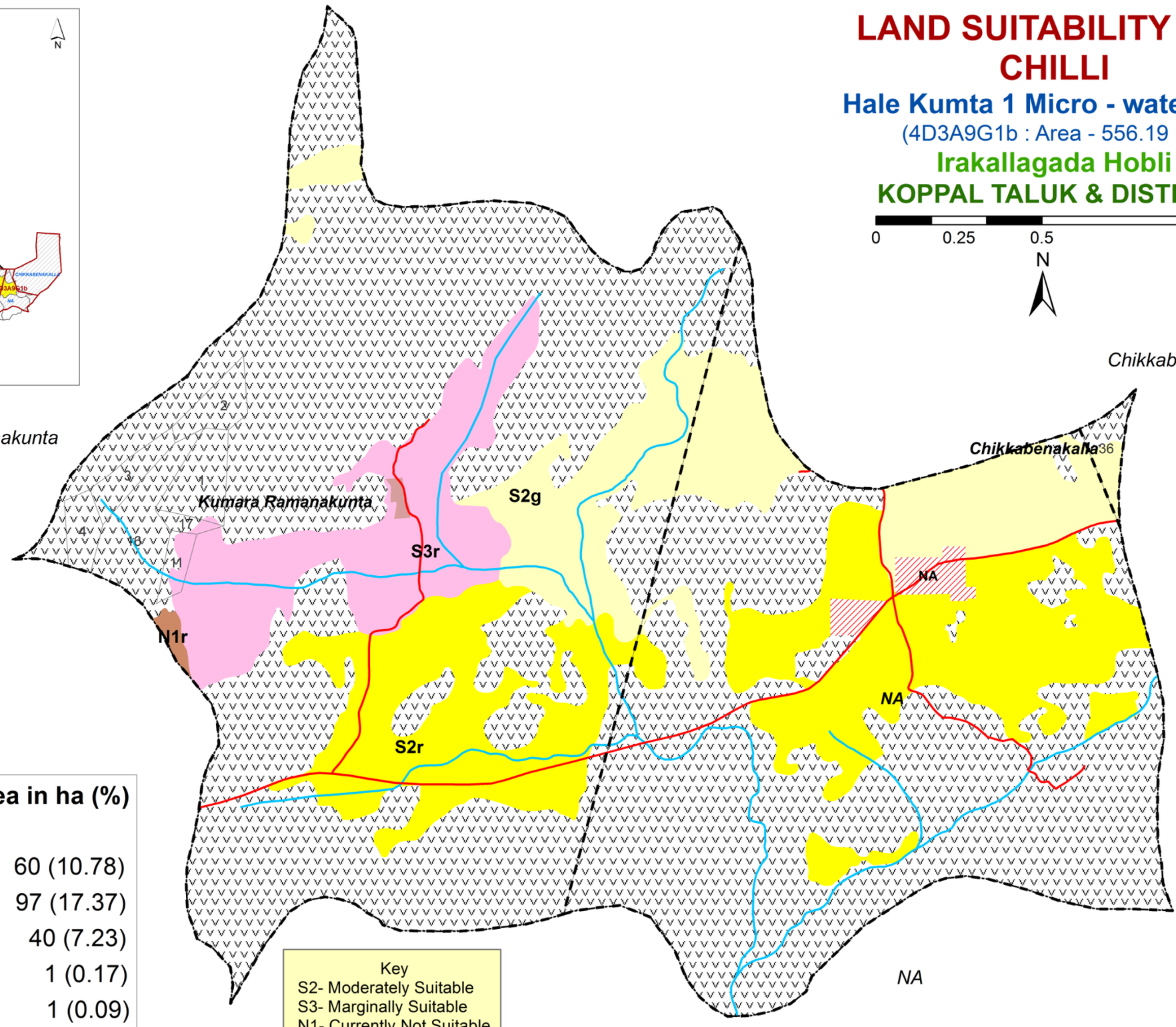
KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla



References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 — Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

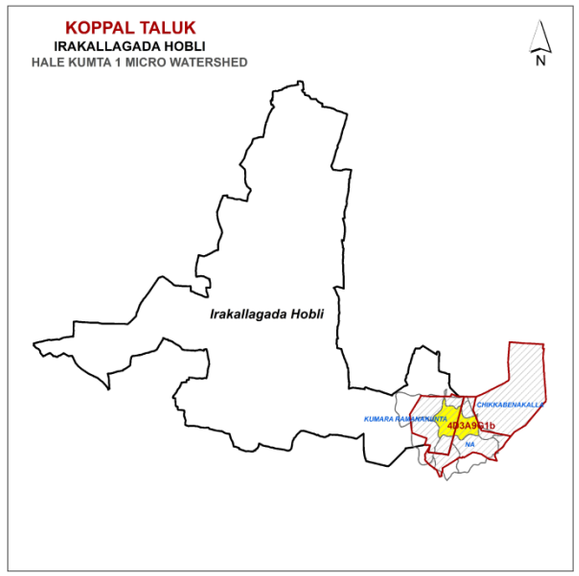
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.11. Land Suitability for Pomegranate



LAND SUITABILITY FOR POMEGRANATE

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

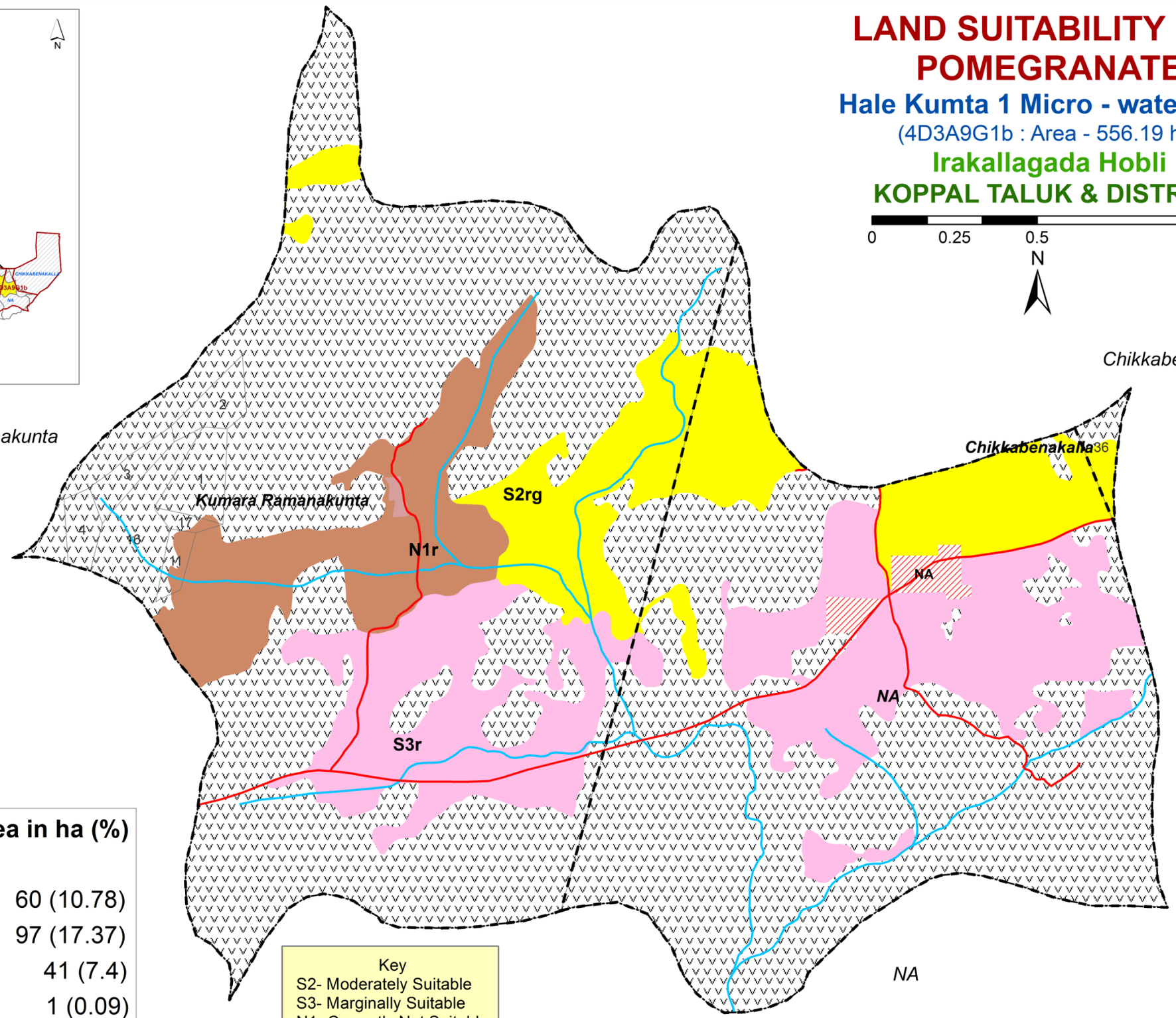
Irakallagada Hobli

KOPPAL TALUK & DISTRICT

km
0 0.25 0.5 1
N

Kumara Ramanakunta

Chikkabenakalla



References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2rg	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

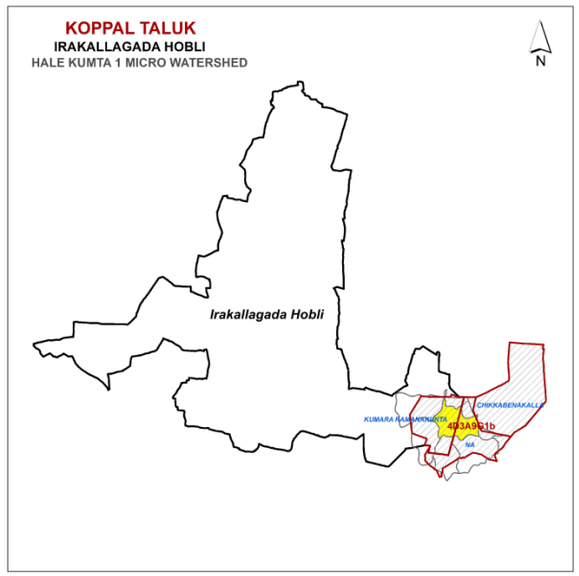
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.12. Land Suitability for Tomato



LAND SUITABILITY FOR TOMATO

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla 36

S2g

S3r

N1r

S2r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

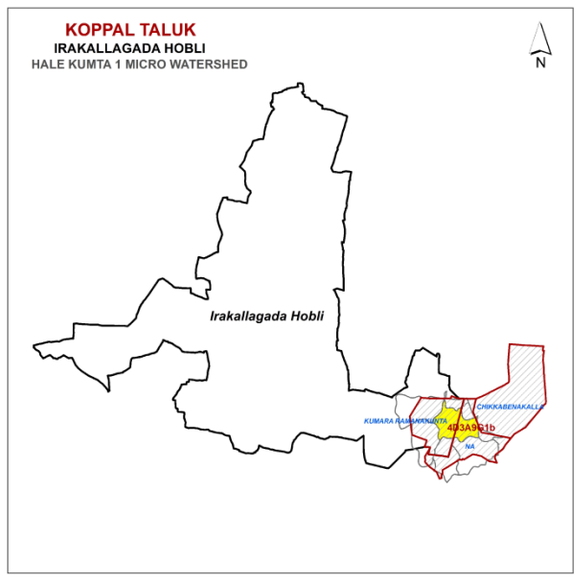
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.13. Land Suitability for Mulberry



LAND SUITABILITY FOR MULBERRY

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

S2r

N1r

S3r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2r	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

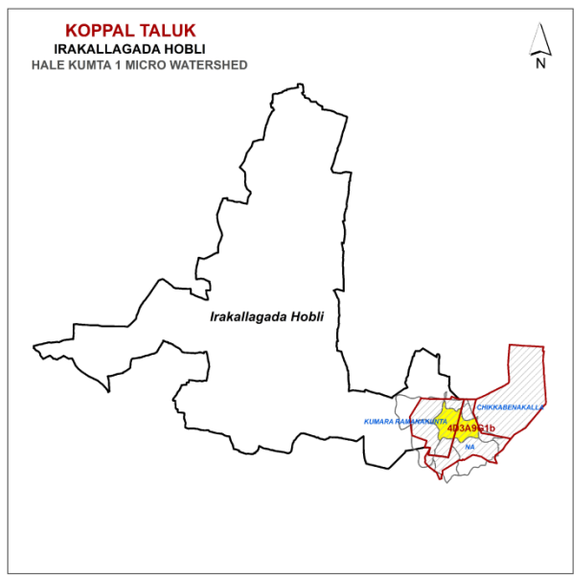
Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

NOTE: Mulberry suitability evaluation only for mulberry leaf, not for silkworm rearing

7.14. Land Suitability for Bhendi



LAND SUITABILITY FOR BHENDI

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Chikkabenakalla 36

Kumara Ramanakunta

S2g

S3r

S2r

N1r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

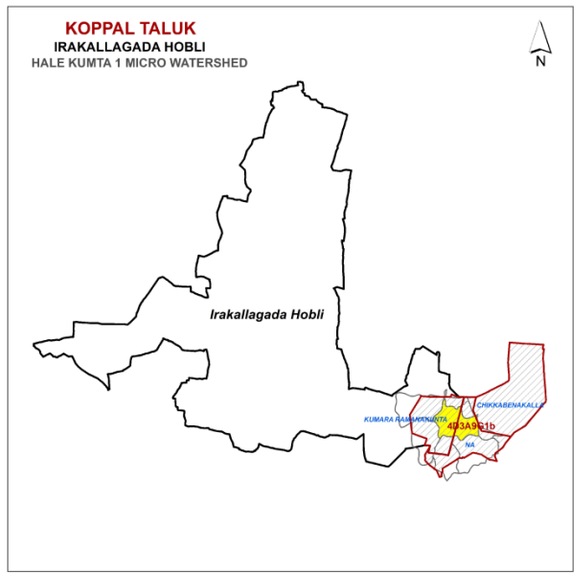
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.15. Land Suitability for Guava



LAND SUITABILITY FOR GUAVA

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

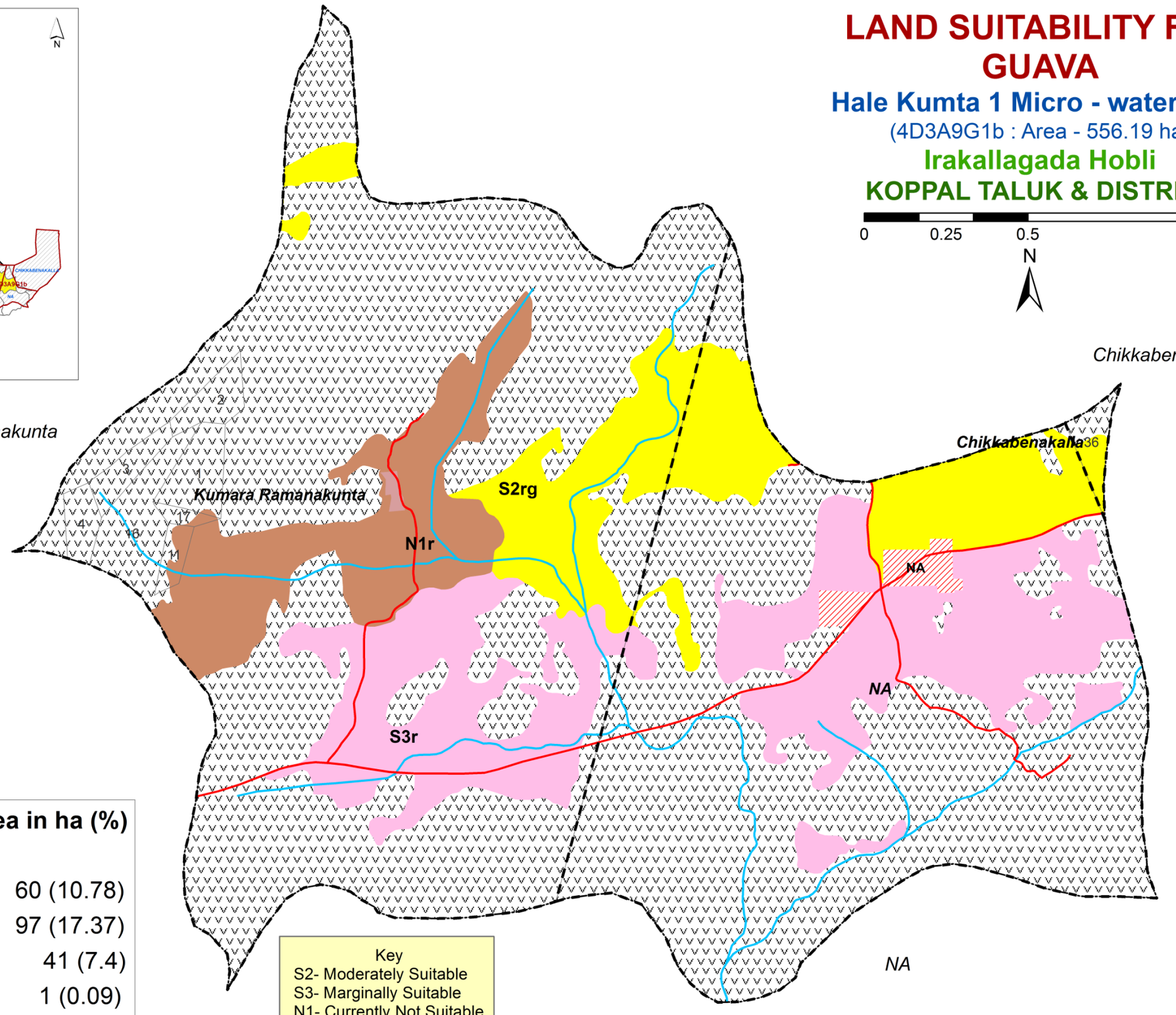
KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla



References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2rg	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.16. Land Suitability for Mango

LAND SUITABILITY FOR MANGO

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

NA

NA

NA

S3r

N1r

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 — Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S3r	60 (10.78)
N1r	138 (24.78)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

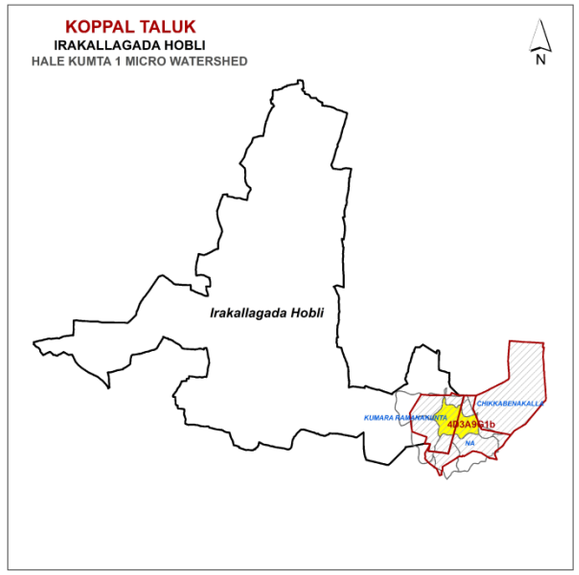
* - Habitation

Key
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.17. Land Suitability for Sapota



LAND SUITABILITY FOR SAPOTA

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

km
0 0.25 0.5 1
N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

S2rg

N1r

S3r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2rg	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.18. Land Suitability for Jackfruit

LAND SUITABILITY FOR JACKFRUIT

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2rg	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

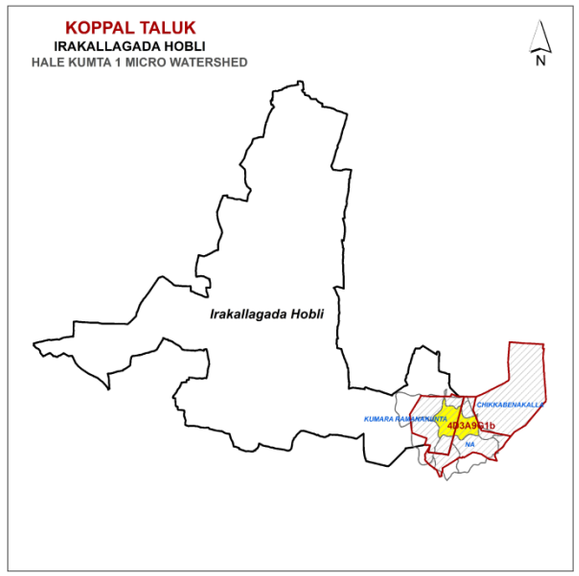
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.19. Land Suitability for Jamun



LAND SUITABILITY FOR JAMUN

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

N1r

S3r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S3r	157 (28.15)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

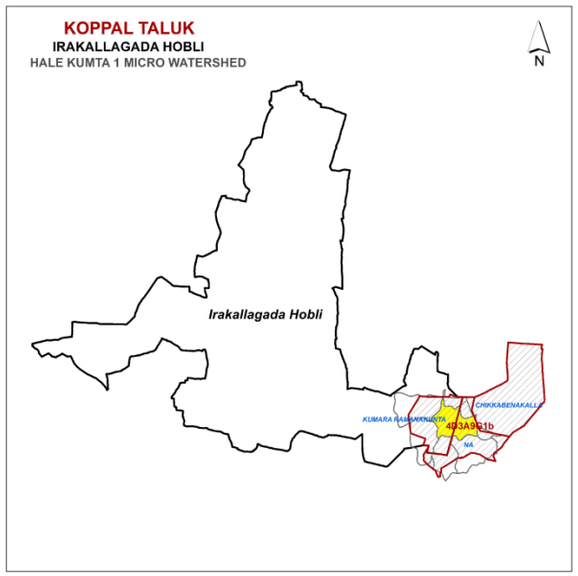
* - Habitation

Key
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.20. Land Suitability for Musambi



LAND SUITABILITY FOR MUSAMBI

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

NA

S2rg

N1r

S3r

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2rg	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

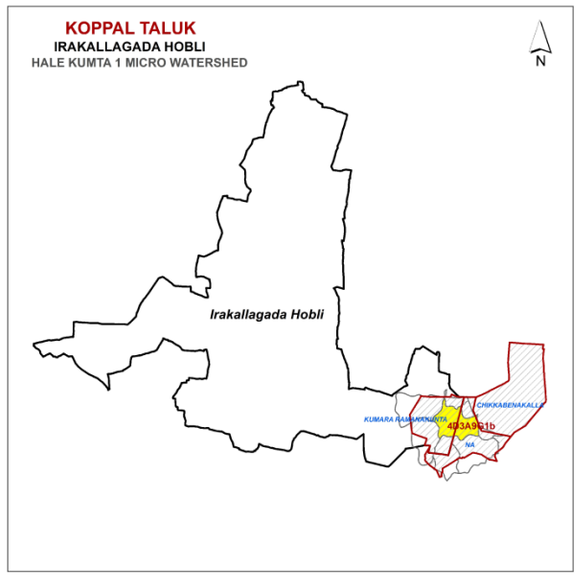
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.21. Land Suitability for Lime



LAND SUITABILITY FOR LIME

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

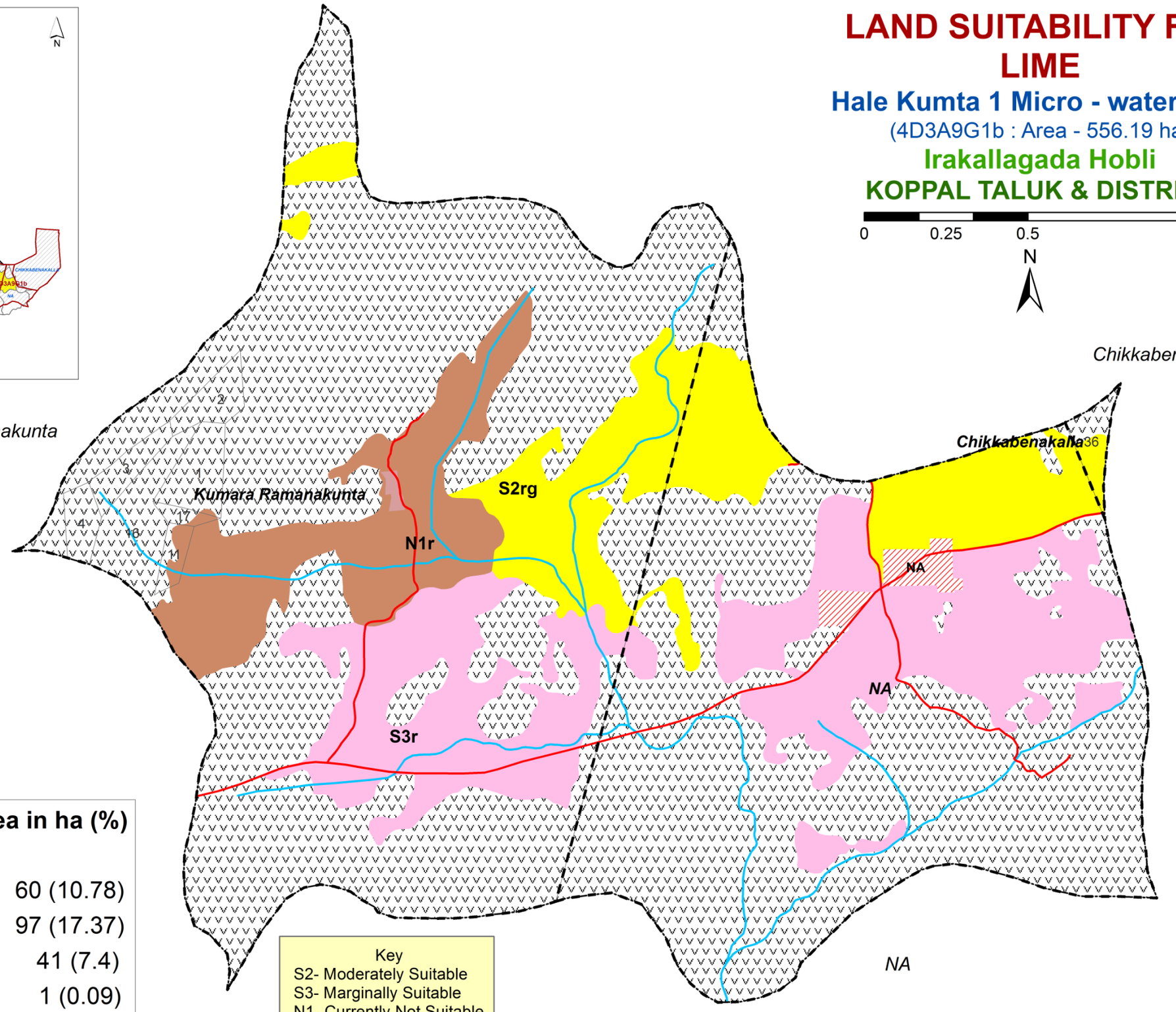
KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla



References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2rg	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

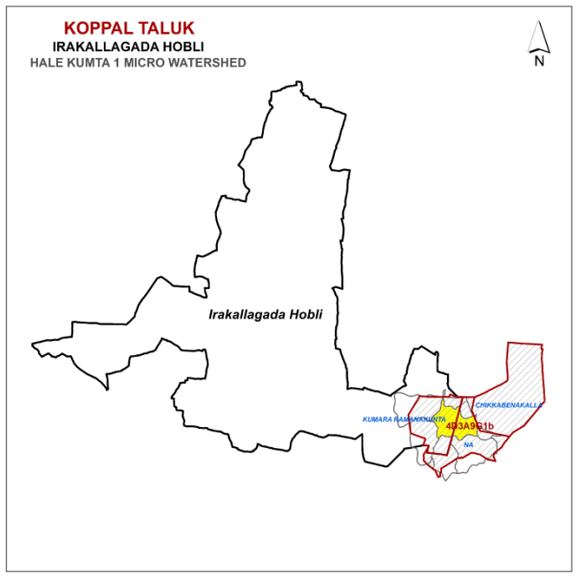
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.22. Land Suitability for Cashew



LAND SUITABILITY FOR CASHEW

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

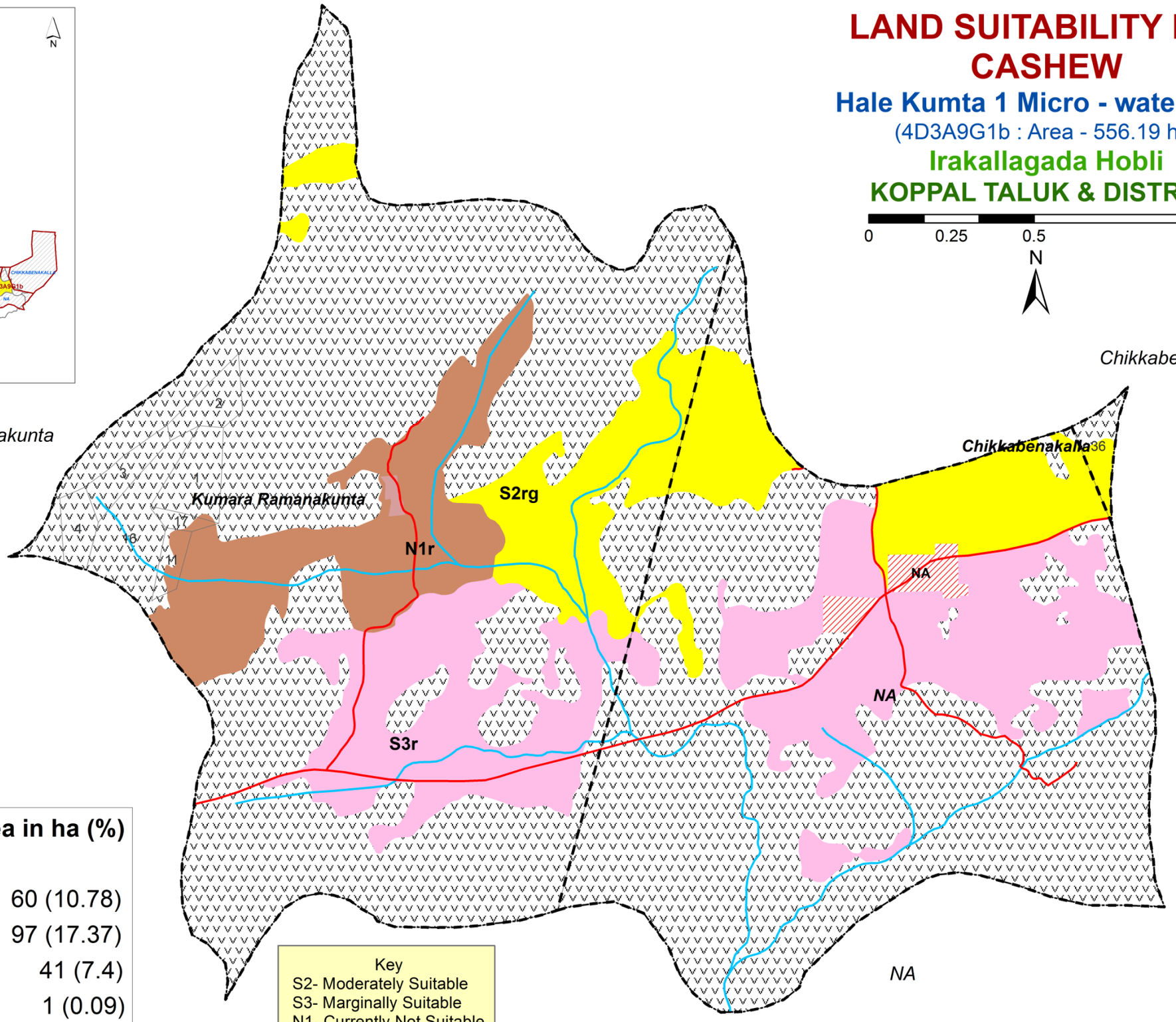
KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla



References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2rg	60 (10.78)
S3r	97 (17.37)
N1r	41 (7.4)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.23. Land Suitability for Custard Apple

LAND SUITABILITY FOR CUSTARD APPLE

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

km
0 0.25 0.5 1
N

Kumara Ramanakunta

Chikkabenakalla

Chikkabenakalla

NA

NA

Kumara Ramanakunta

S1

S3r

N1r

S2r

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S1	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

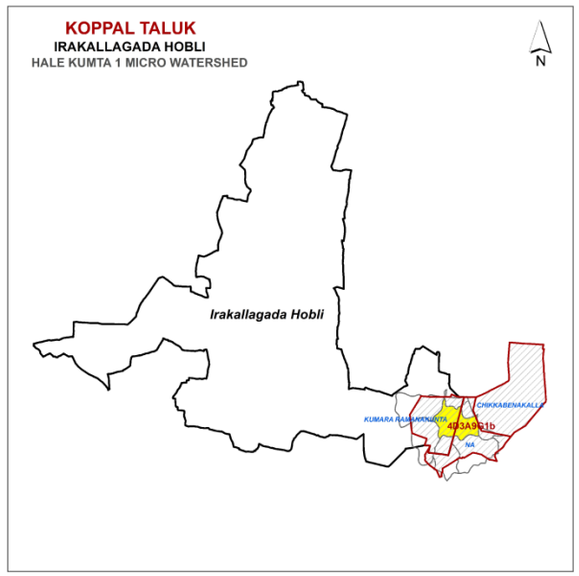
* - Habitation

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.24. Land Suitability for Amla



LAND SUITABILITY FOR AMLA

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S1	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

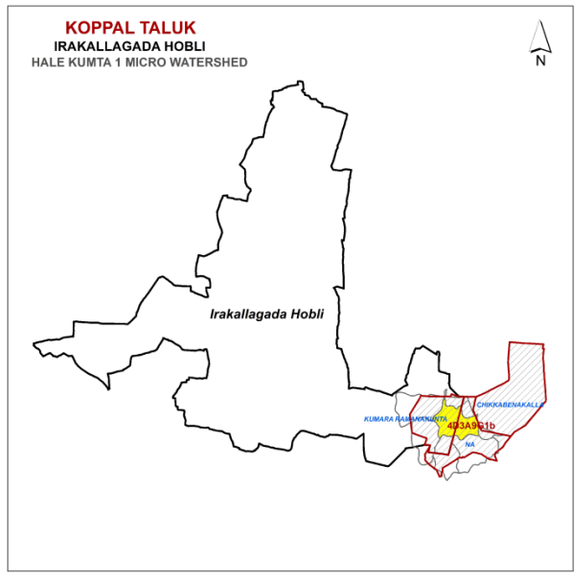
* - Habitation

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.25. Land Suitability for Tamarind



LAND SUITABILITY FOR TAMARIND

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

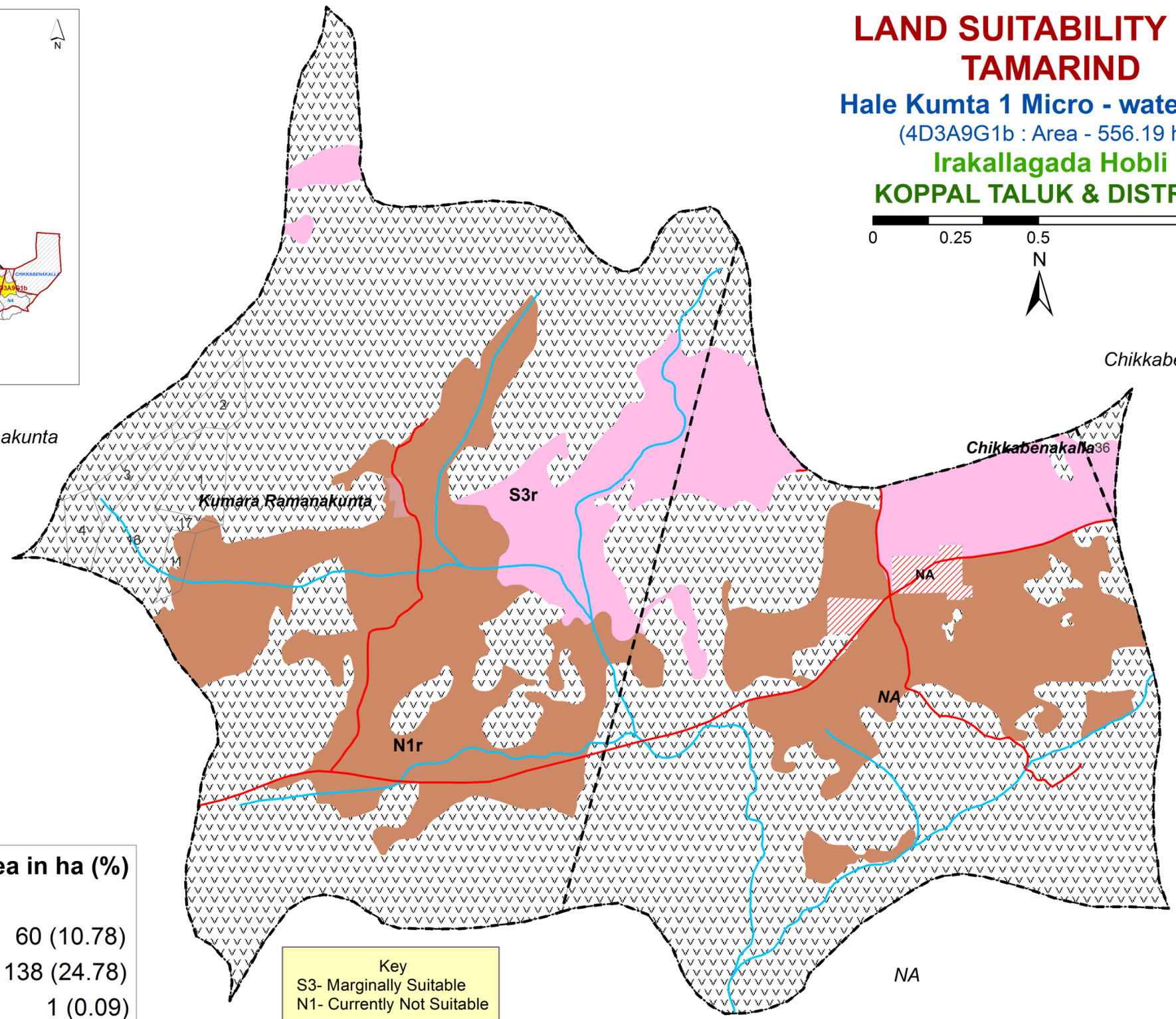
KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla



References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S3r	60 (10.78)
N1r	138 (24.78)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.26. Land Suitability for Brinjal

LAND SUITABILITY FOR BRINJAL

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

S2g

S3r

S2r

N1r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 — Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

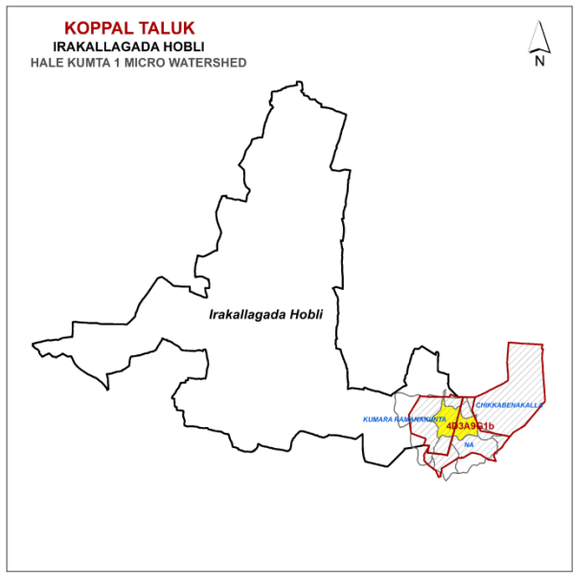
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.27. Land Suitability for Onion



LAND SUITABILITY FOR ONION

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

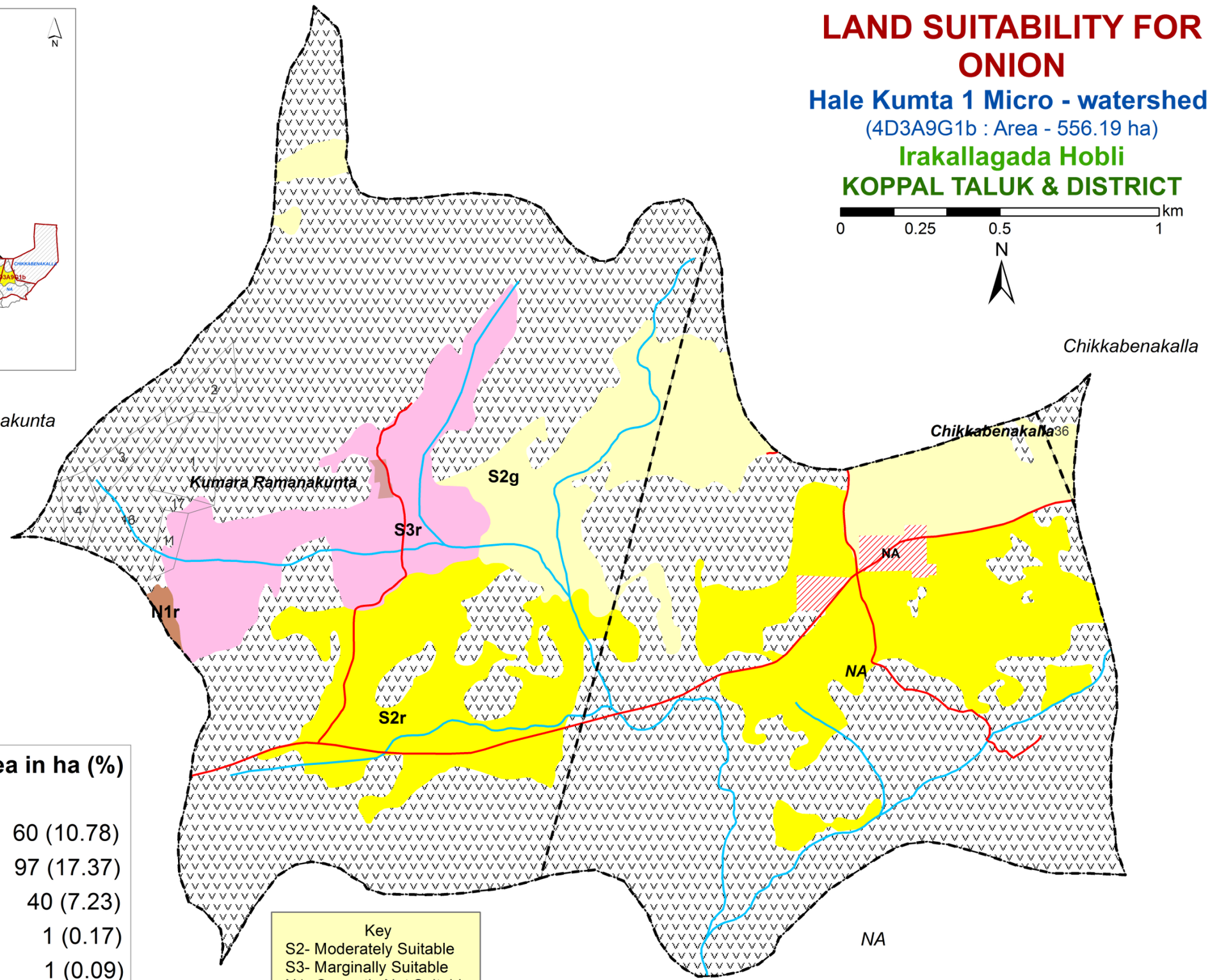
KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla



References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 — Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.28. Land Suitability for Jasmine

LAND SUITABILITY FOR JASMINE

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

S2g

S3r

S2r

N1r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 — Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

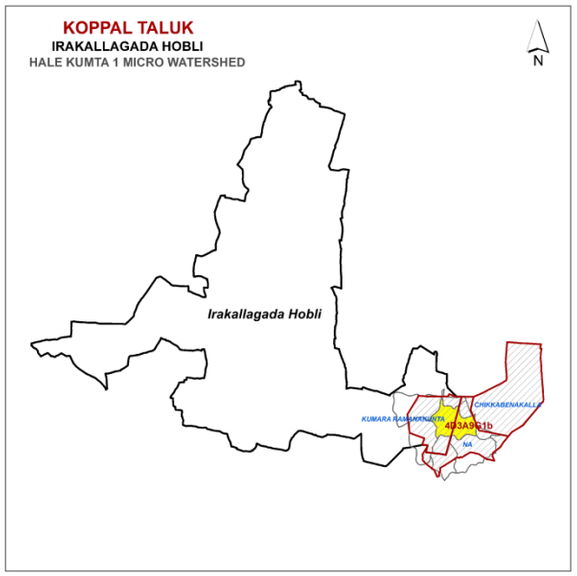
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.29. Land Suitability for Crossandra



LAND SUITABILITY FOR CROSSANDRA

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Chikkabenakalla

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.30. Land Suitability for Marigold

LAND SUITABILITY FOR MARIGOLD

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Kumara Ramanakunta

Chikkabenakalla

S2g

S3r

S2r

N1r

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 — Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

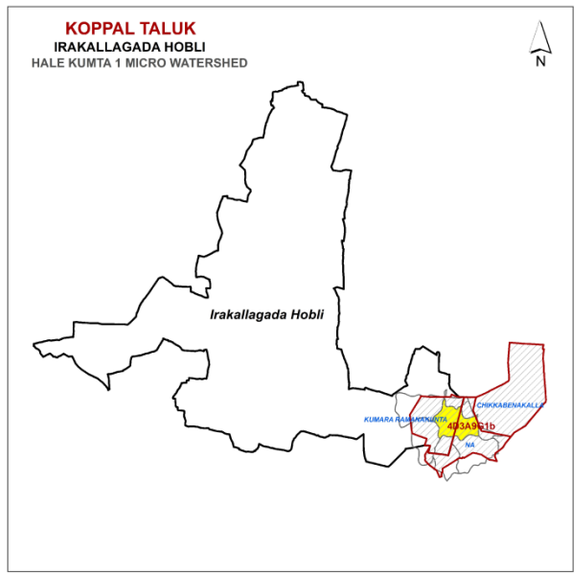
* - Habitation

Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

7.31. Land Suitability for Chrysanthemum



LAND SUITABILITY FOR CHRYSANTHEMUM

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

Suitability subclass	Area in ha (%)
S2g	60 (10.78)
S2r	97 (17.37)
S3r	40 (7.23)
N1r	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

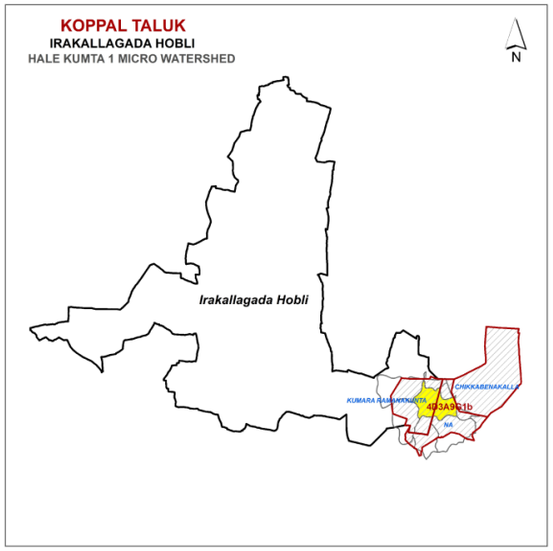
Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
r- rooting condition

Source: ICAR-NBSS&LUP, Bengaluru

8. Soil and Water Conservation Measures

8.1. Soil & Water Conservation Plan



SOIL & WATER CONSERVATION PLAN

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

Chikkabenakalla 36

Kumara Ramanakunta

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 — Land parcel with No's
- Village boundary
- Micro-watershed boundary

Legend	Area in ha (%)
Trench cum bunding	197 (35.38)
Graded bunding	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Source: ICAR-NBSS&LUP, Bengaluru

9. Land Management Units

LAND MANAGEMENT UNITS

Hale Kumta 1 Micro - watershed

(4D3A9G1b : Area - 556.19 ha)

Irakallagada Hobli

KOPPAL TALUK & DISTRICT

0 0.25 0.5 1 km

N

Kumara Ramanakunta

Chikkabenakalla

*Chikkabenakalla*36

Kumara Ramanakunta

Mining/Industrial

LMU-1

LMU-3

LMU-4

LMU-2

NA

NA

NA

References

- Streams/Drainage
- Road/Cart track
- Habitation
- 3 Land parcel with No's
- Village boundary
- Micro-watershed boundary

LMU	Area in ha (%)
LMU-1	60 (10.78)
LMU-2	97 (17.37)
LMU-3	40 (7.23)
LMU-4	1 (0.17)
Mining/Industrial	1 (0.09)
Rock outcrops	354 (63.6)
Others*	4 (0.75)

* - Habitation

Source: ICAR-NBSS&LUP, Bengaluru

NOTE: *Proposed Crop Plan for LMU's are given in Table*

10. Table. Proposed Crop Plan for Hale Kumta1 Micro-watershed, Irakallagada Hobli, Koppal Taluk, Koppal District based on soil-site–crop suitability Assessment

LMU. No	Soil Map Units	Survey Number	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
1	158.BSRbB2g1 162.BSRhB2g1 (Moderately deep, red gravelly sandy clay soils)	**Kumara Ramanakunta:** 16	Maize, Sorghum, Groundnut, Sunflower, Bajra, Mulberry, Cotton, Red gram	**Fruit crops** : Sapota, Pomegranate, Amla, Cashew, Custard apple, Guava, Jackfruit, Lime, Musambi, **Vegetables:** Tomato, Chillies, Drumstick, Onion, Bhendi, Brinjal, Curry leaves **Flowers:** Marigold, Chrysanthemum**,** Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit *etc*)
2	69.KGHhB2g1 (Moderately shallow, red gravelly loamy soils)	**Kumara Ramanakunta:** 16	Maize, Sorghum, Groundnut, Bajra, Cotton, Horse gram, Castor	**Fruit crops** : Amla, Custard apple **Vegetables:** Tomato, Chilli, Onion, Bhendi, Brinjal ,Curry leaves **Flowers:** Marigold, Chrysanthemum, Jasmine, Crossandra	Drip irrigation, mulching, suitable soil and water conservation practices (Crescent Bunding with Catch Pit *etc*)
3	36.CSRcB2g1 41.CSRmB1 (Shallow, red loamy soils)	**Kumara Ramanakunta :** 11	Green gram, Black gram, Horse gram	**Agri-Silvi-Pasture:** Custard apple, Hybrid Napier, *Styloxanthes hamata*, Glyricidia, *Styloxanthes scabra*	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers
4	4.BGThB2g1 (Very shallow, gravelly black clay soils)	**Kumara Ramanakunta:** 16	-	**Agri-Silvi-Pasture:***Styloxanthes hamata, Styloxanthes scabra*	Suitable soil and water conservation practices

PART - B

Hydrological Inventory of Hale Kumta Sub-watershed, Koppal Taluk, Koppal District, Karnataka for Watershed Planning and Development

Sujala - III
Karnataka Watershed Development Project-II
Watershed Development Department
Government of Karnataka

THE WORLD BANK

Hydrological Inventory of Hale Kumta Sub-watershed, Koppal Taluk, Koppal District, Karnataka for Watershed Planning and Development

Prepared by
ICAR-National Bureau of Soil Survey and Land Use Planning
Regional Centre, Hebbal, Bangalore - 560 024

ICAR - NBSS & LUP

Phone:080-23412242

E-mail: hd_rcb.nbsslup@icar.gov.in
nbssrcb@gmail.com

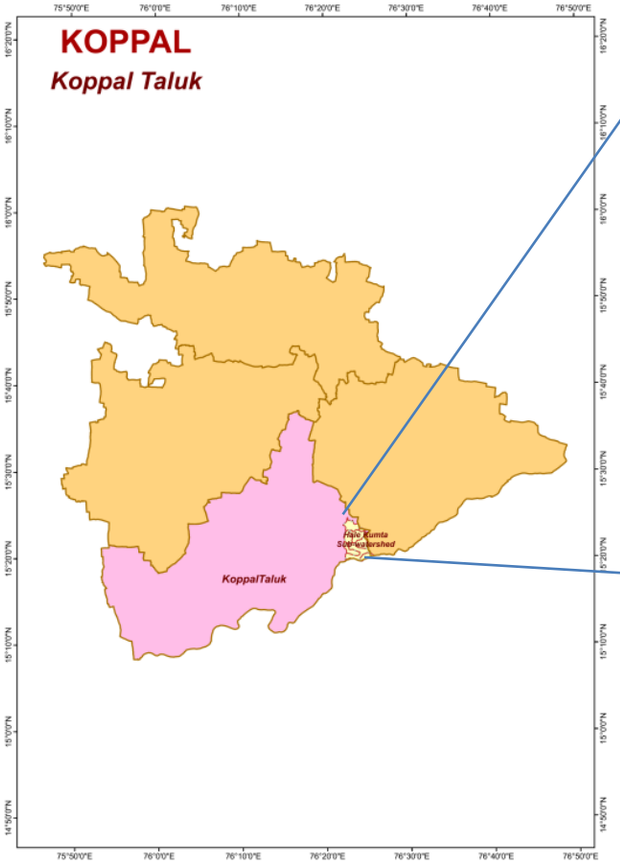
Details of Hydrology Team of LRI Partner Responsible for Preparation of Atlas

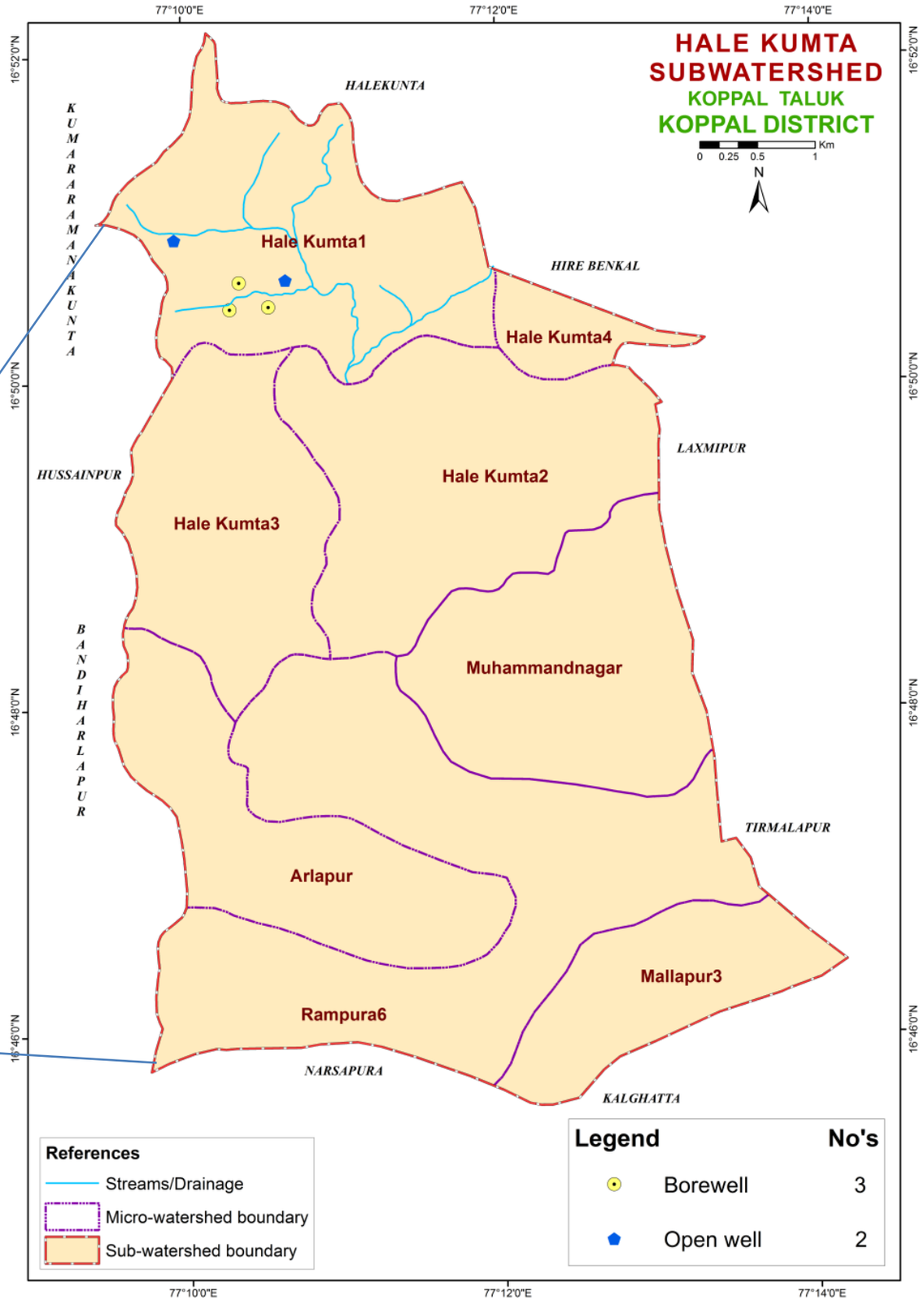
Name	Designation
Dr. Rajendra Hegde	Principal Scientist & Head Coordinator
Dr. S. Srinivas	Principal Scientist
Dr. K .V. Niranjana	Chief Technical Officer
Sh. R.S.Reddy	Consultant
Sh. A.G.Devendra Prasad	Consultant
Smt. K.Karunya Lakshmi	Research Associate
Ms. Seema, K.V.	Senior Research Fellow
Dr. Sekhar Muddu (Reviewed and approved)	Professor & Lead Scientist, Dept. of Civil Engineering & ICWaR, IISc, Bangalore
	Email: hd_rcb.nbsslup@icar.gov.in nbssrcb@gmail.com **Phone: Office:** 080-23412242,23410993 **Fax:** 080-23510350

INTRODUCTION

- The inventory and documentation of spatial and temporal changes in hydrological components of Hale Kumta sub-watershed (4D3A9G) in Koppal taluk, Koppal district, has been undertaken for integrated planning, development and management at the level of soil mapping units.
- Hale Kumta sub-watershed (Koppal taluk, Koppal district) is located between $15^0$19'10''–$15^0$25'5'' North latitudes and $76^0$21'6''–76^0 26'37'' East longitudes, covering an area of about 5629 ha.
- This sub-watershed encompasses of 10 MWs namely, Hale Kumta-1 (4D3A9G1b), Hale Kumta-2 (4D3A9G1c), Hale Kumta-3 (4D3A9G1d), Hale Kumta-4 (4D3A9G1a), Sanapura-1 (4D3A9G2e), Sanapura-2 (4D3A9G2f), Muhammandnagar (4D3A9G2b), Arlapur (4D3A9G2a), Rampura-6 (4D3A9G2c) and Mallapur-3 (4D3A9G2d) micro watersheds. Land Resource Inventory (LRI) was generated for one among the ten micro-watersheds.
- Average annual rainfall (1960-2014) of the Hobli (Block) pertaining to the sub-watershed is 631 mm.
- In this sub-watershed major *kharif* crops grown are Maize, Cotton, Sunflower, Bajra, Groundnut, Red gram and major *rabi* crops are Sorghum, Bengal gram and Safflower.
- Hydrological components namely rainfall (annual, *kharif*, *rabi* and summer), PET, AET, runoff, surface soil moisture, ground water status and water balance are presented.

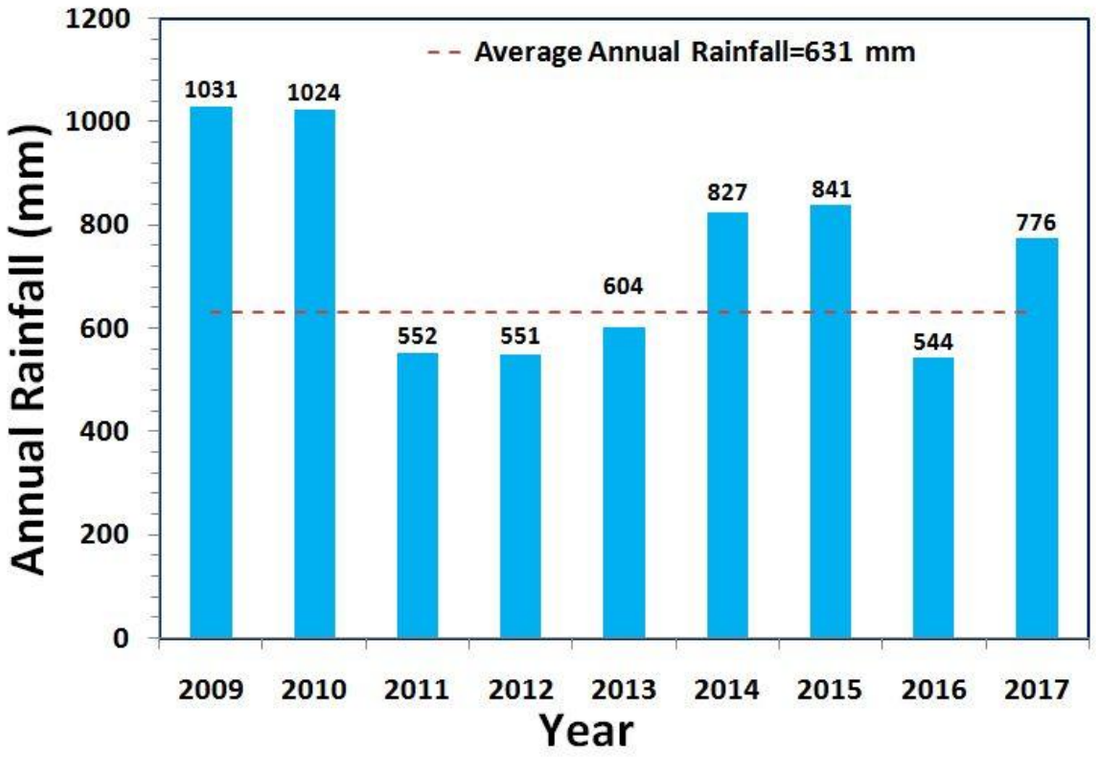
LOCATION MAP OF HALE KUMTA SUB-WATERSHED





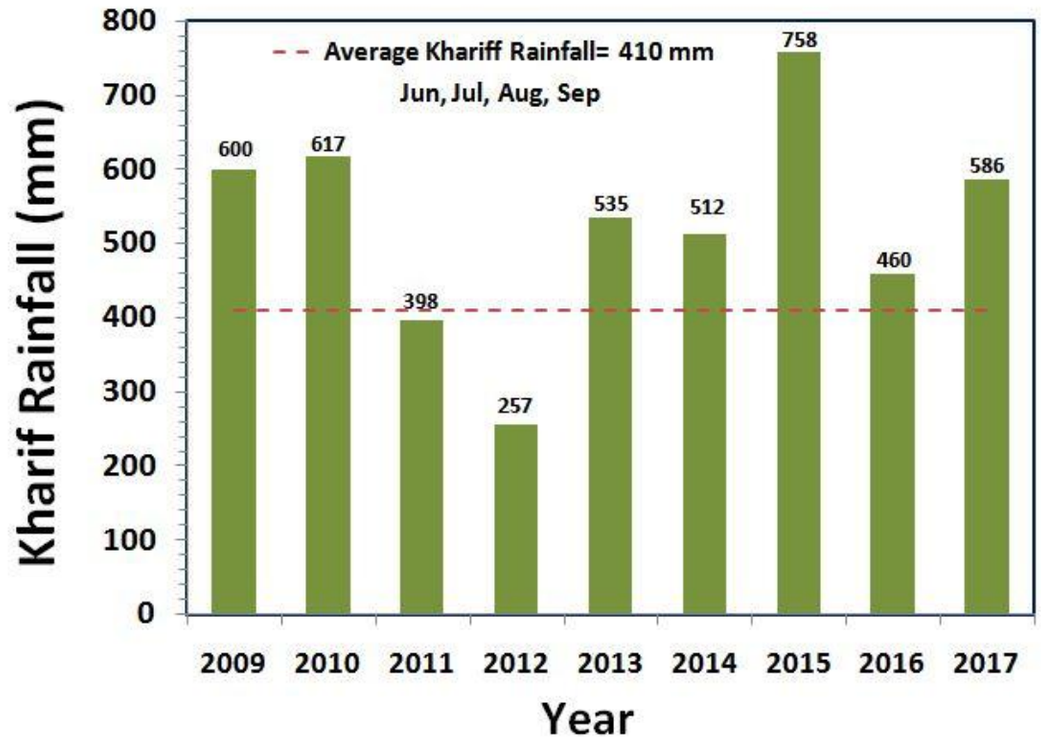
Soil & Water Conservation Structures in Hale Kumta Sub-watershed, Koppal taluk, Koppal district

RAINFALL INDEX

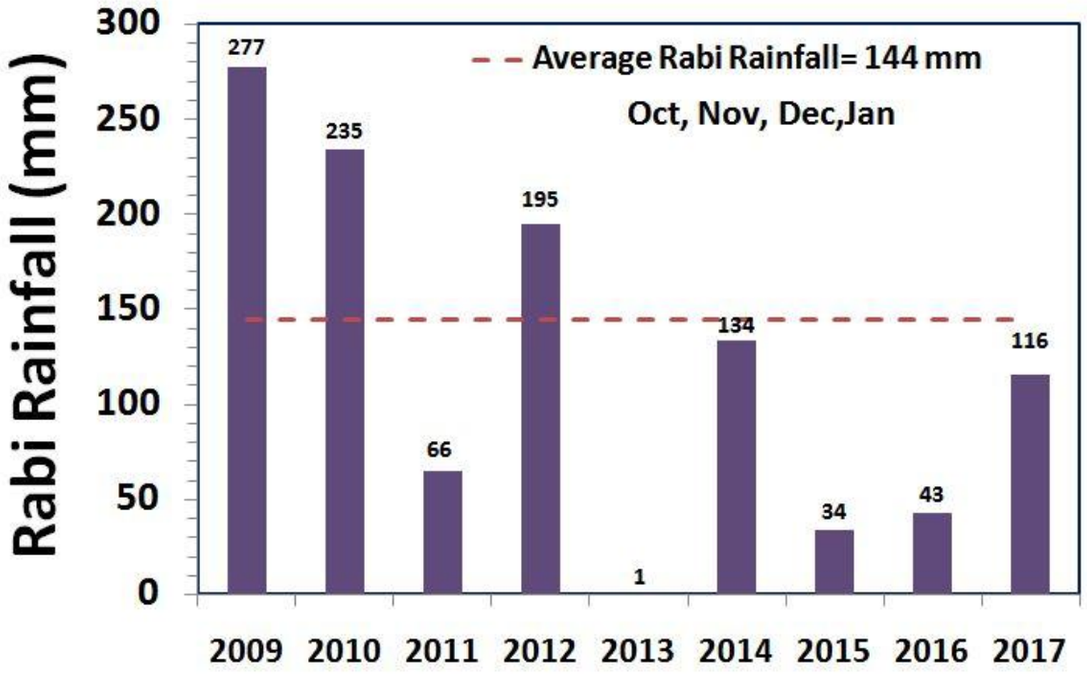


The average annual rainfall (1960-2014) recorded at the Koppal Station in Koppal Taluk of Koppal District is 631 mm. The annual rainfall at Hitnal station (Hobli H.Q.) is presented. During the years 2011, 2012, 2013 and 2016 the annual rainfall was deficient by 13, 13%, 4% and 14% respectively.

The *kharif* rainfall (Jun–Sep) is an average about 71% of the annual rainfall and it typically follows the annual rainfall patterns. During the years 2011 and 2012 the *kharif* rainfall was deficient by 3% and 37% respectively.

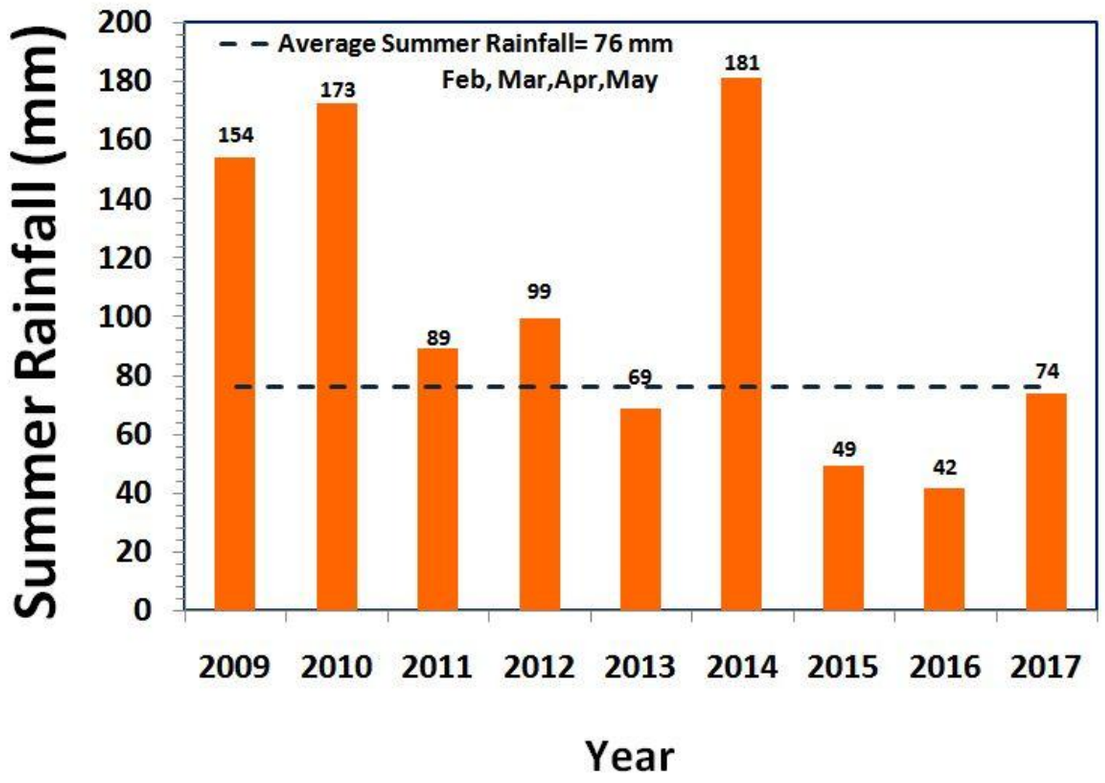


RAINFALL INDEX

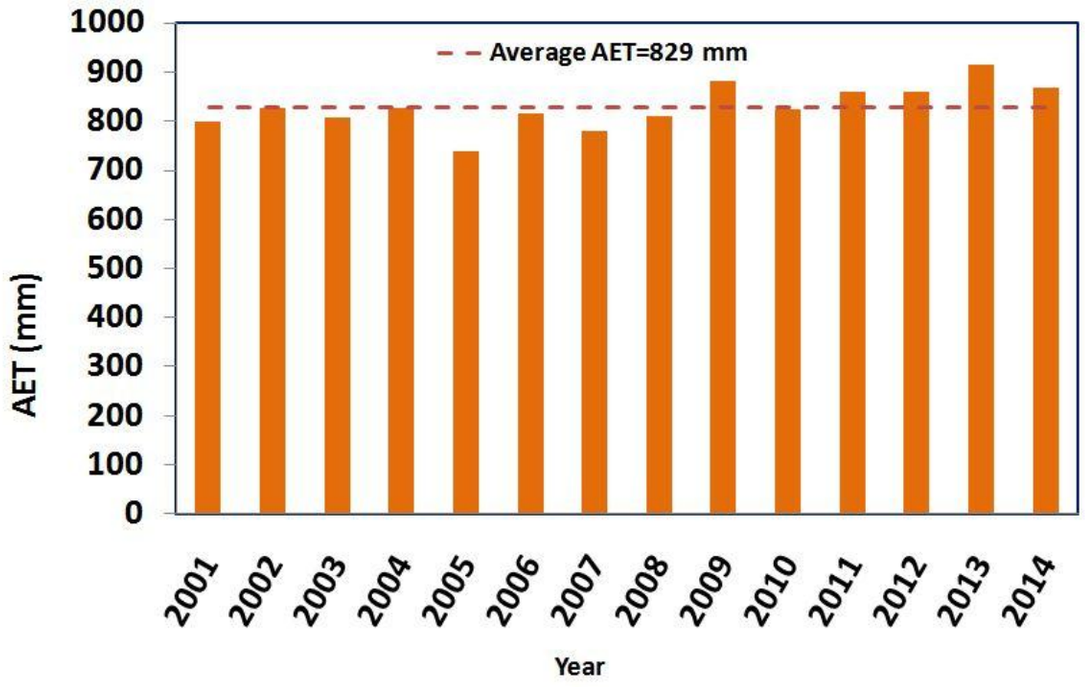


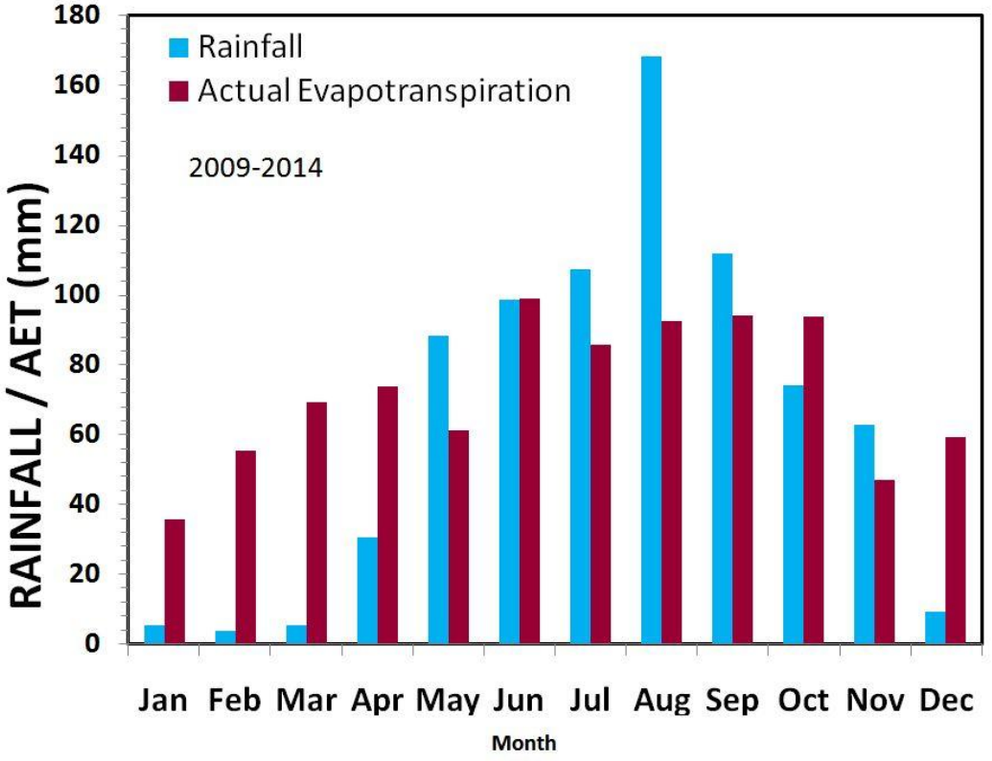
The average *rabi* rainfall (Oct-Jan) is about 16% of the average annual rainfall. During the years 2011, 2012, 2013, 2014, 2015, 2016 and 2017 the *rabi* rainfall was deficient by 54, 99%, 7%, 76%, 70% and 19% respectively.

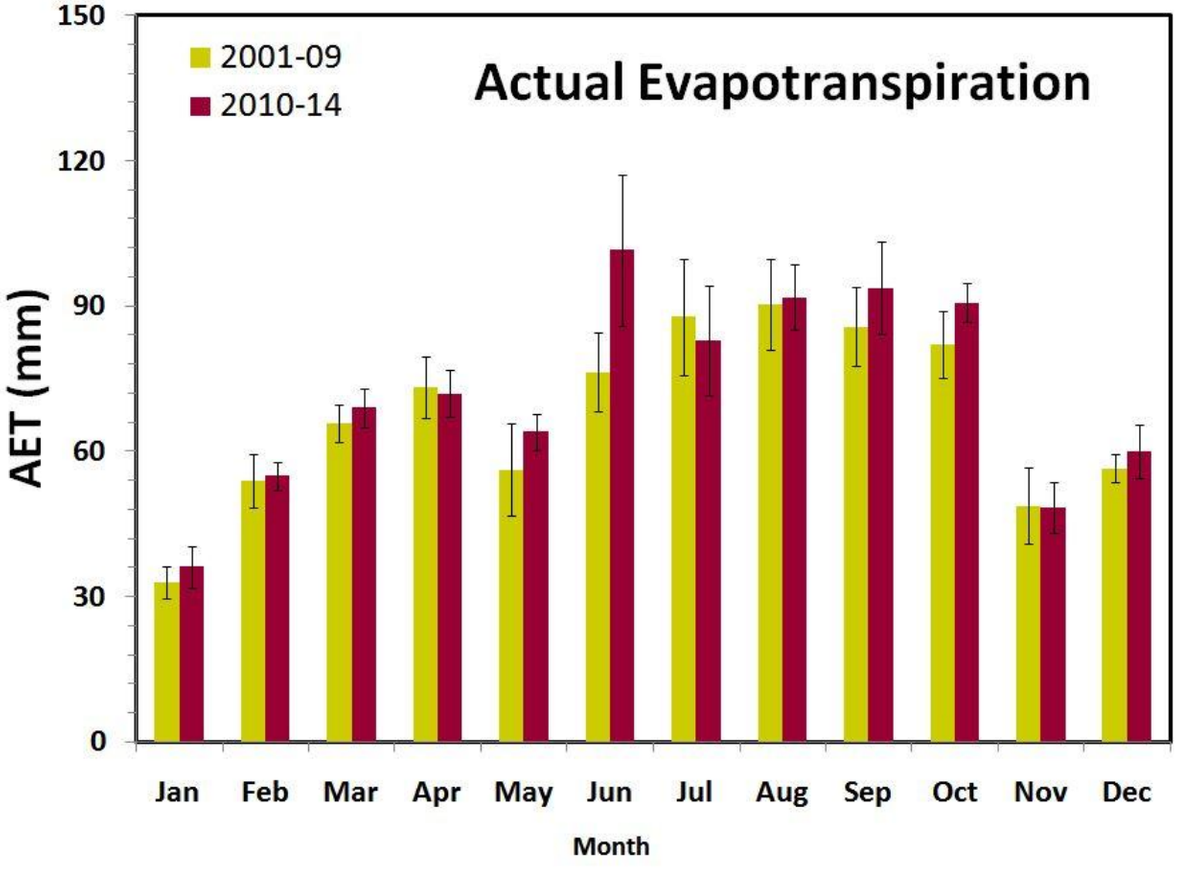
The average summer rainfall (Feb-May) is about 14% of the average annual rainfall.



EVAPOTRANSPIRATION

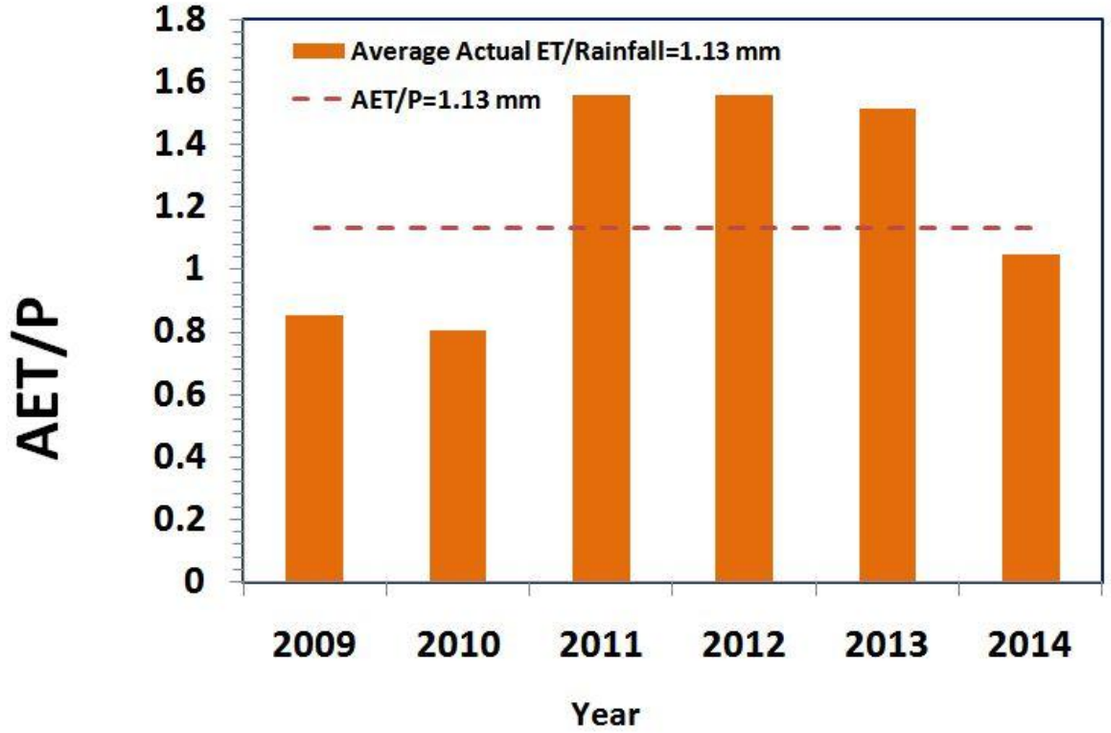


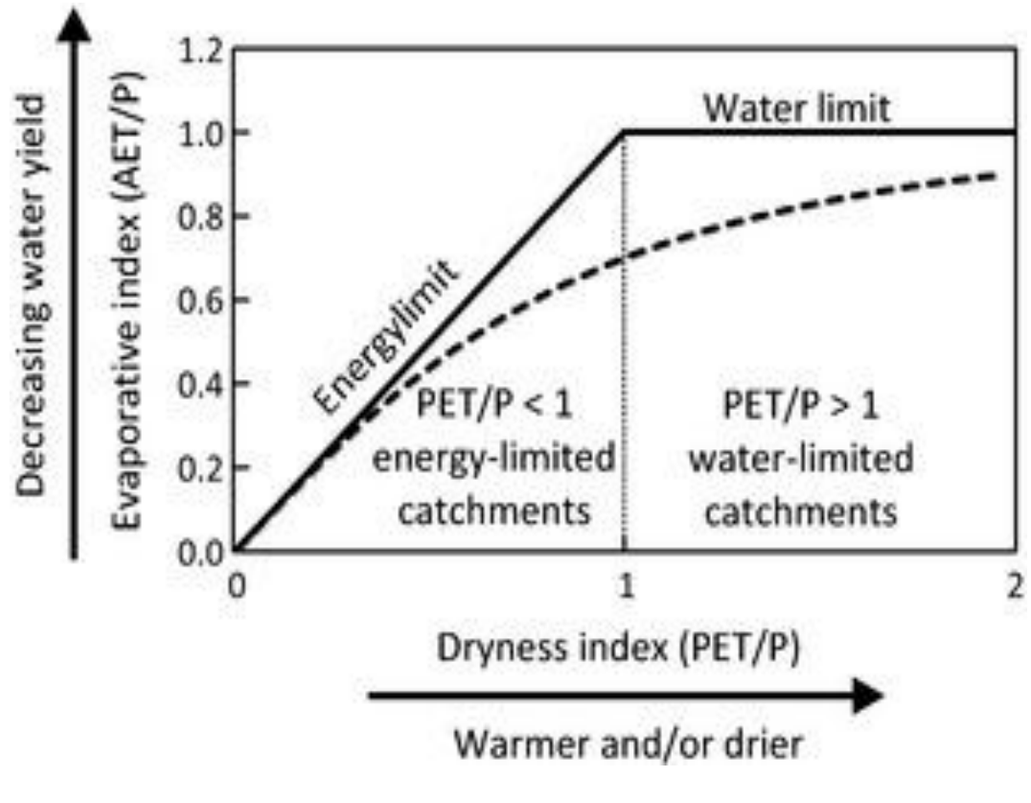




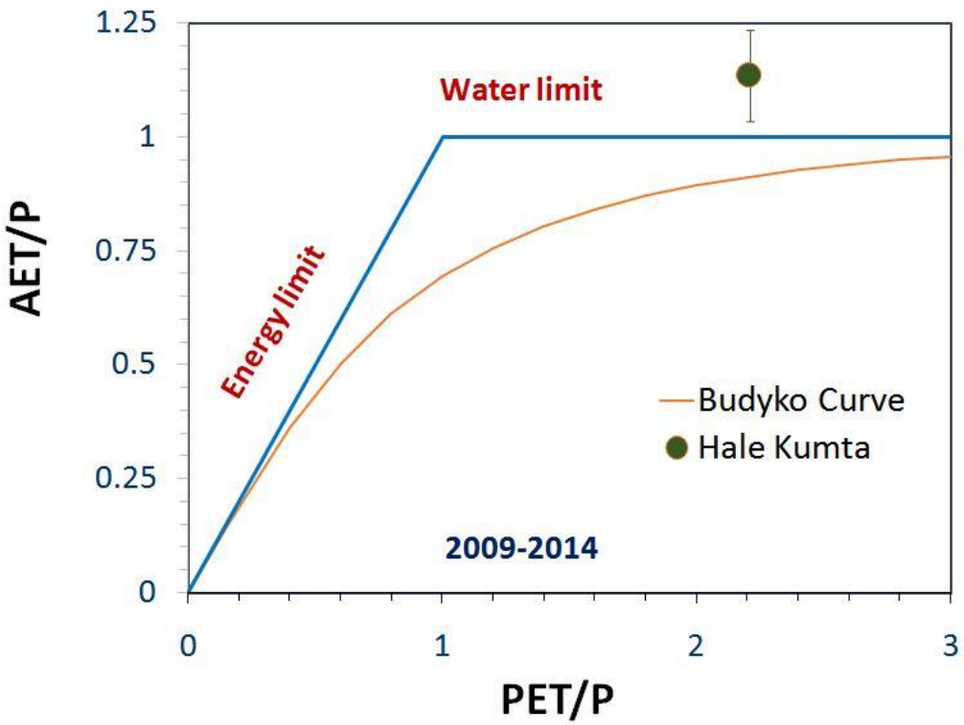
The average annual actual ET is higher than the average annual rainfall. During *kharif*, average rainfall and ET was found to be 525 mm and 372 mm respectively, whereas in *rabi* it was about 122 mm and 236 mm. In comparison to the 2001-2009, the annual ET increased by 6% during 2010-2014.

EVAPOTRANSPIRATION INDEX

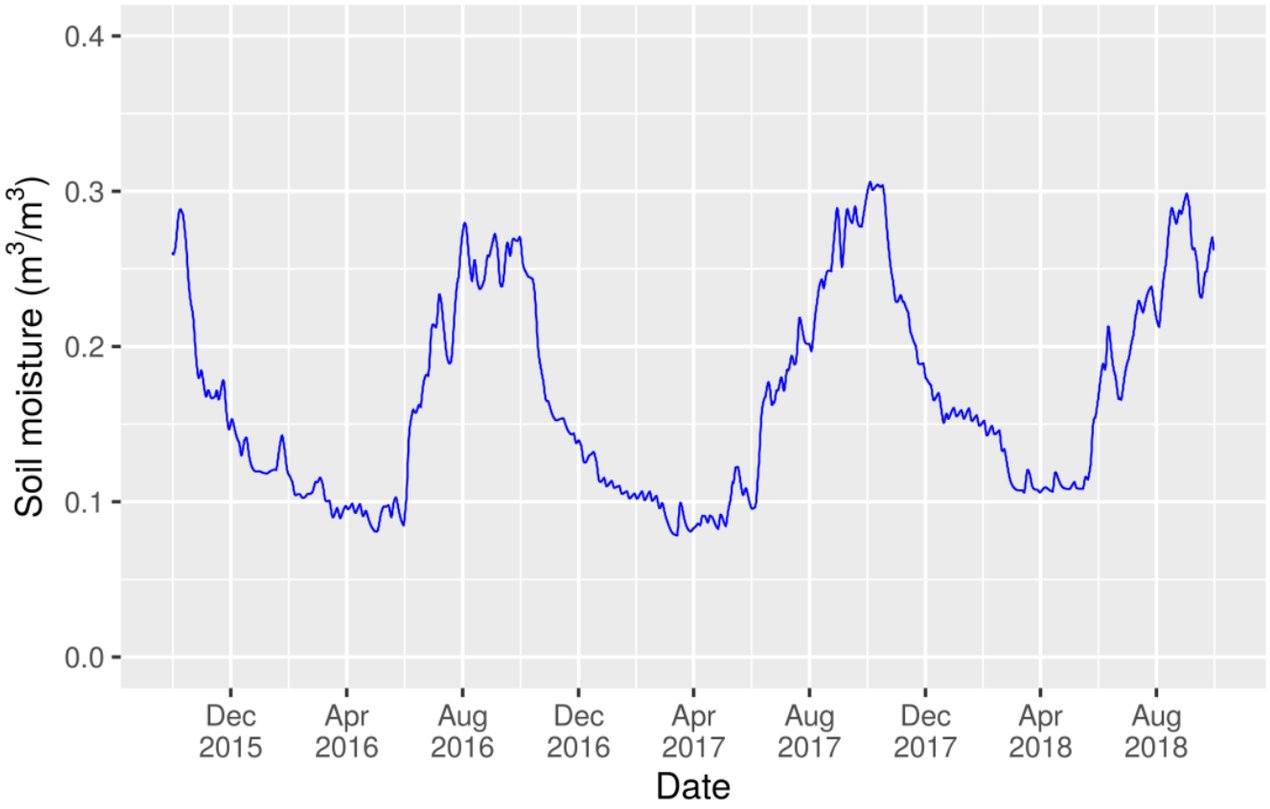




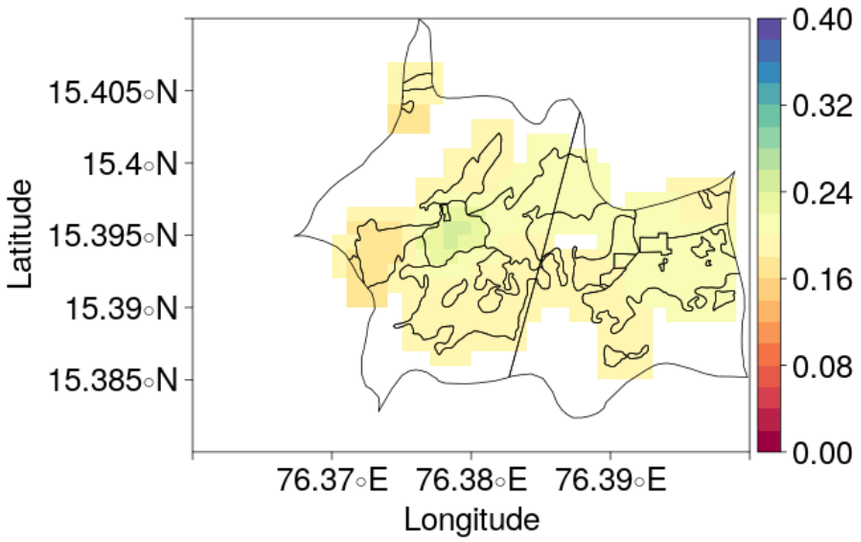
The average AET/P ratio was about 113%, which is higher than the sustainable limit of about 80%. Even during extremely lower rainfall year of 2012, AET was 830 mm. This suggests the presence of water storage and utilization from other sources such as groundwater, which buffered the lower rainfall.



SATELLITE RETRIEVED SOIL MOISTURE

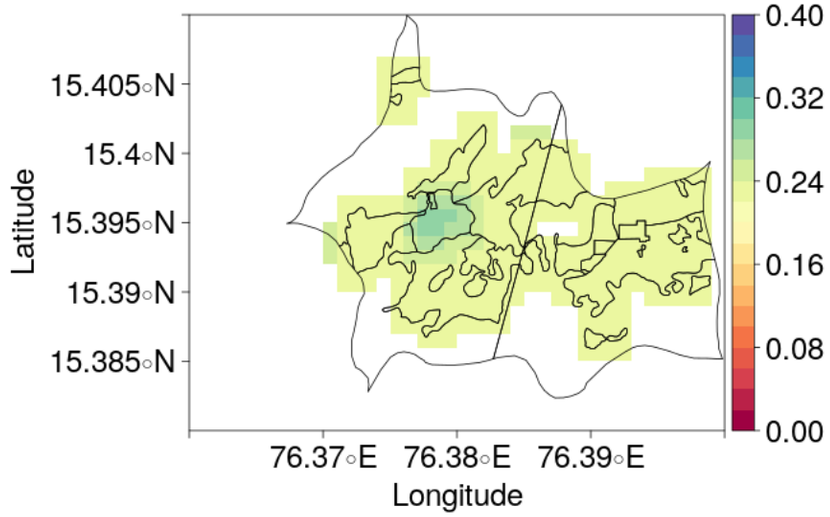


Hale Kumta– *rabi* Soil Moisture



The method developed for retrieving soil moisture from multi-satellite observations allowed to map surface soil moisture behavior in the micro-watershed. The available surface moisture was varied in the range of 9-26% in *kharif* and 11-26 % in *rabi* seasons of 2016 and 10-29% in *kharif* and 16-30% in *rabi* seasons of 2017.

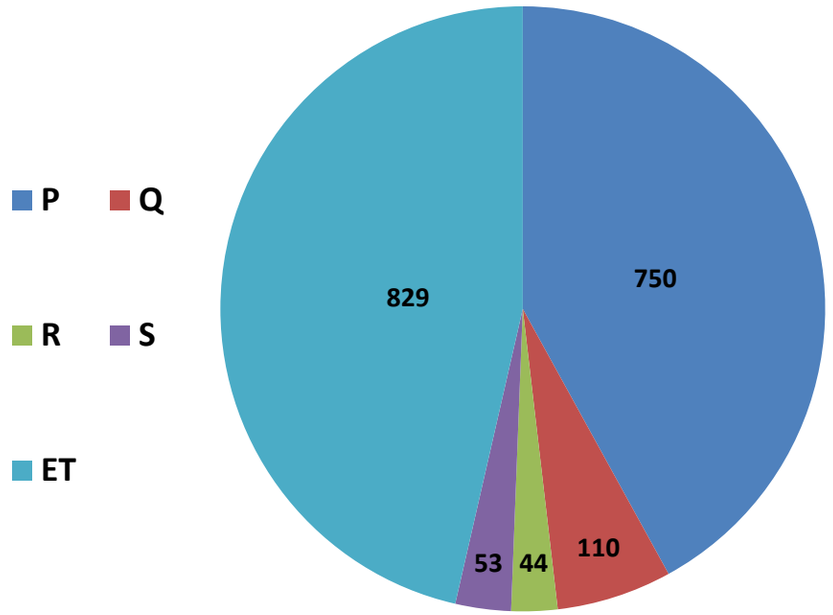
Hale Kumta –*kharif* Soil Moisture



WATER BALANCE

$$Q = P - E - R - S$$

- Q = Runoff
- P = Precipitation
- E = Evapotranspiration
- R = Groundwater recharge
- S = Soil moisture storage change

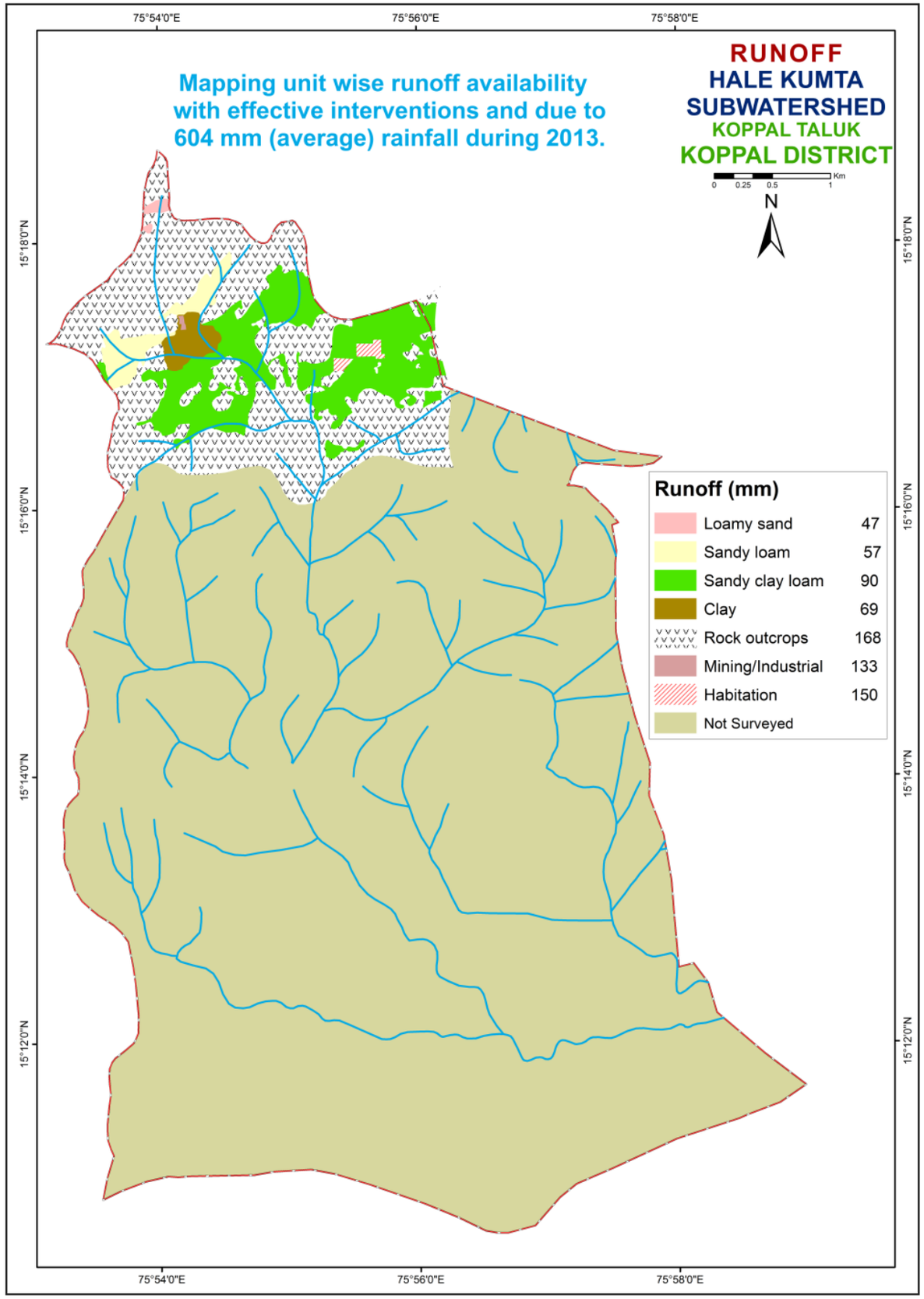


During July-September months, Precipitation is higher than Evapotranspiration, hence Runoff can occur in the watershed.

P = 750 mm (average of 2009-2017) ET = 829 mm R = 44 mm S = 53 mm Q = 110 mm

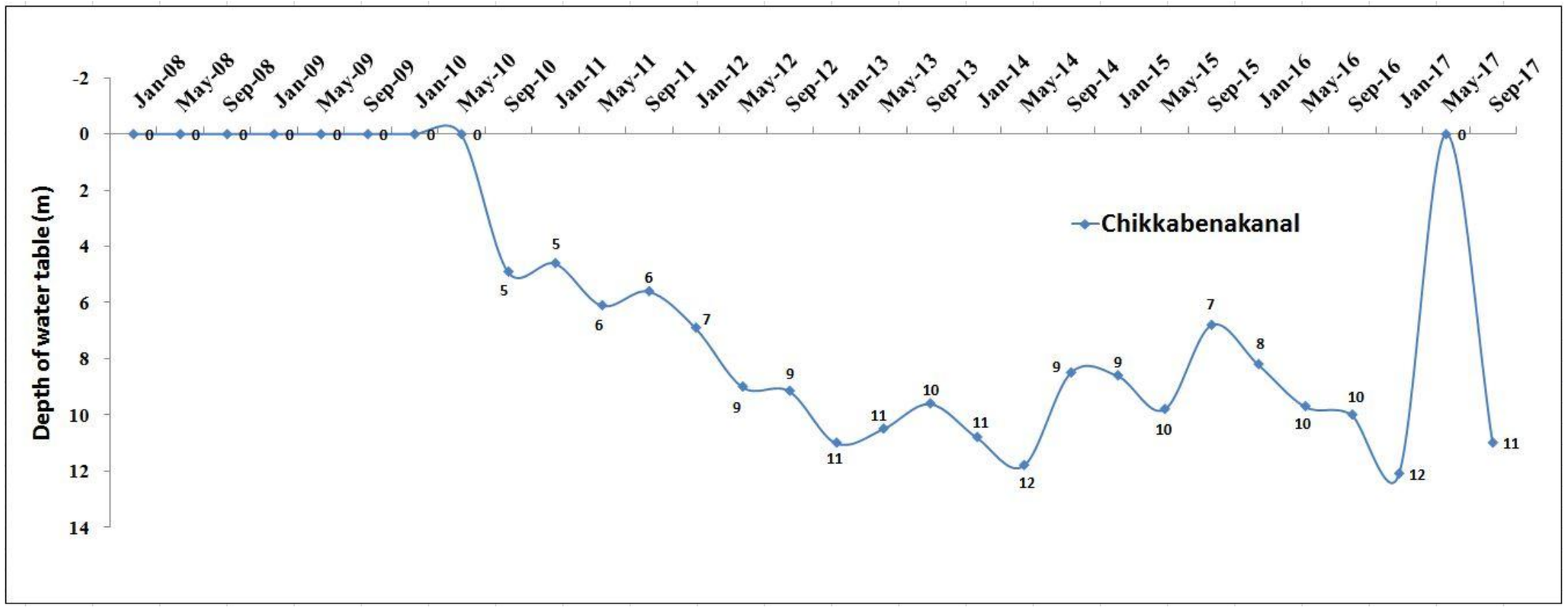
Sl. No.	Parameters	Average_ 2013 (mm)
1.	Rainfall	604
2.	Runoff availability with existing conditions	148
3.	Runoff availability with effective interventions	137
4.	Runoff allowed as environmental flow at the outlet	27
5.	Runoff excess for harvesting by construction of structures	110

RUNOFF


RUNOFF
HALE KUMTA
SUBWATERSHED
KOPPAL TALUK
KOPPAL DISTRICT
Mapping unit wise runoff availability with effective interventions and due to 604 mm (average) rainfall during 2013.
0 0.25 0.5 1 Km
N
Runoff (mm)
Loamy sand 47
Sandy loam 57
Sandy clay loam 90
Clay 69
Rock outcrops 168
Mining/Industrial 133
Habitation 150
Not Surveyed
75°54'0"E
75°56'0"E
75°58'0"E
15°18'0"N
15°16'0"N
15°14'0"N
15°12'0"N

GROUND WATER STATUS

CHIKKABENAKANAL STATION



The total number of wells present in Hale Kumta Sub-watershed as per LRI data are 5 (3-Borewells 2-Open wells). The groundwater level was found from the data obtained from KSNDMC for the nearest station Chikkabenakanal. The above graph depicts the groundwater levels during the years 2008-2010 were constant. Whereas groundwater levels during the years 2010-2017 was slightly varying except May-2017.

SUMMARY

- The average annual rainfall of 631 mm in the Hale Kumta sub-watershed as recorded from the Hitnal station data by KSNDMC.

- 71 percent, 16 percent and 14 percent of the annual rainfall occurs during *kharif*, *rabi* and summer seasons respectively and exhibited a higher temporal variability.

- The evapotranspiration estimation tool developed indicates that the watershed water balance is in deficit. The cropping & irrigation choices are not appropriate and need to be altered to shift the deficit water balance.

- The estimated runoff available to use is 110 mm for an average annual rainfall of 750 mm (2009-2017). The utilizable groundwater is 31 mm (70% of 44 mm recharge estimated). This means the total available water resource combining the soil moisture store for kharif & rabi (53 mm) and utilizable runoff plus recharge is 194 (=53+110+31)

- The average actual evapotranspiration estimated in the watershed based on the current land use and irrigation practices for the kharif and rabi seasons is 608 mm. Hence the amount of water use for kharif and rabi seasons may be estimated as 760 mm (i.e 125% of AET). This demand for the two seasons is higher by 566 mm, i.e. (760-194). The AET in June-Sept months is 76% of rainfall. Hence, there is a good opportunity to harvest the excess water through watershed management practices for utilizing during rabi season.

- The total number of wells present in Hale Kumta Sub-watershed as per LRI data is 5 (3-Borewells 2-Open wells). The groundwater level was found from the data obtained from KSNDMC for the nearest station Chikkabenakanal .