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ICAR-NBSS&LUP Sujala SWs-LRI Atlas No. 36

Land Resource and Hydrological Inventory of Thanagunda Sub-watershed for Watershed Planning and Development Yadgir Taluk, Yadgir District, Karnataka (AESR 6.2)

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

ICAR - NBSS & LUP

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.

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PART - A

Land Resource Inventory of Thanagunda Sub-watershed for Watershed Planning and Development Yadgir Taluk, Yadgir District, Karnataka (AESR 6.2)

CONTENTS

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How to read and use the Atlas

The Land Resource Inventory of Thanagunda Sub-watershed (Yadgir Taluk, Yadgir District) for Watershed Planning (AESR 6.2) 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.

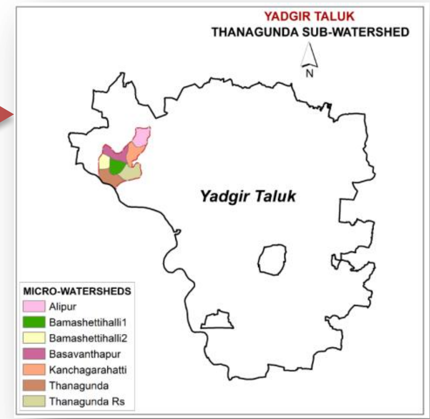
For easy map reading and understanding the information contain in different maps, the physical, cultural and scientific symbols used in the maps are illustrated in the form of colors, graphics and tables.

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.

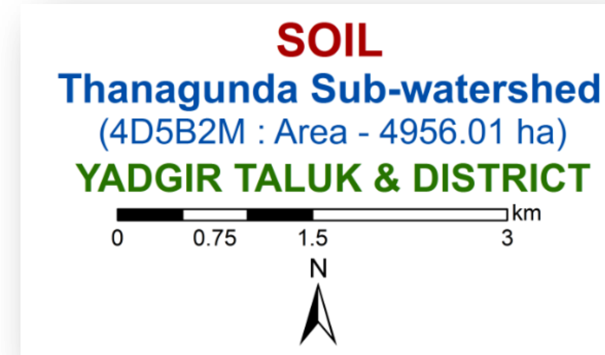
Inset map

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



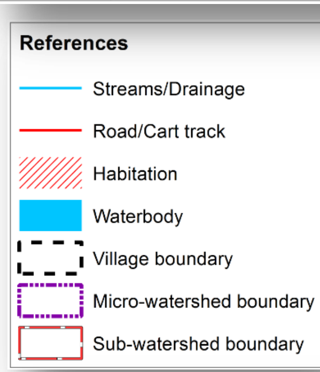
Map title

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 Phase	Area in ha (%)	Soil Phase	Area in ha (%)
Soil of Granite and Granite Gneiss Landscape			
2, BDLbB2	229 (4.61)	62, BMNmB2	154 (3.1)
3, BDLbC3	11 (0.21)	159, BMNmA1	205 (4.13)
4, BDLhB2	168 (3.39)	11, SBRcB2	61 (1.23)
162,BDLhB2g1	65 (1.31)	49, NGPmB2	64 (1.3)
8, VNKbB2g1	25 (0.49)	118, BDPcB2	62 (1.25)
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34, GWDcB2	202 (4.07)	112, SHTmB2	11 (0.23)
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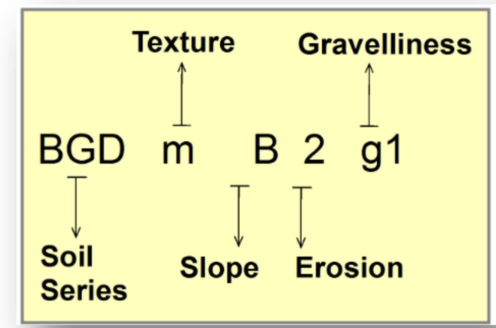
126, HSLhB2	99 (1.99)	151, BGDmB2g1	104 (2.1)
55, ANRiB2	31 (0.62)	177, BGDiA1	154 (3.1)
167, ANRcA1	22 (0.45)	153, KKRbB2g1	46 (0.93)
57, MDGcB2	96 (1.93)	175, KKRcB2	17 (0.35)
58, MDGiB2	40 (0.81)	156, HTKbB2	53 (1.07)
148, MDGhB2	24 (0.48)	161, HTKbB2g1	55 (1.11)
59, MDRcB2	106 (2.14)	20, JNKcB2	220 (4.44)
60, MDRiA1	101 (2.04)	166, JNKcA1	63 (1.26)
132, MDRhB2	177 (3.57)	178, JNKbB2g2	33 (0.66)
133, MDRiB2	46 (0.93)		
Low Land		Rock outcrops	422 (8.51)
116, KDHiB2	30 (0.61)	Others*	392 (7.92)
Railway	18 (0.36)		

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.

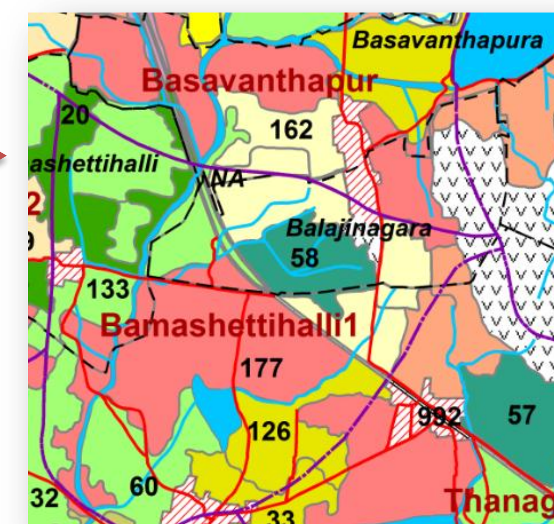


Map colours

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

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.



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.

KEY

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

SLOPE
A - Nearly level (0-1%)
B - Very gently sloping (1-3%)

EROSION
1 - Slight
2 - Moderate
3 - Severe

GRAVELLINESS
g1 – Gravelly (15-35 %)
g2 - Very gravelly (35-60%)

DEPTH
BDP,KKR- Very shallow (<25 cm)
BDL,VNK,DSB,HTK - Shallow (25-50 cm)
HLG,JNK,SBR -Moderately shallow(50-75 cm)
BLC,GWD,HSL,KDH,PGP,SHT - Moderately deep (75-100 cm)
ANR,BGD,MDG,NGP, - Deep (100-150 cm)
BMN,MDR - Very deep (>150 cm)

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
w- drainage
z- excess salt/calcareousness

1. 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 major landforms identified in the 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 Thanagunda Sub-watershed covering an area of 4956.01 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.

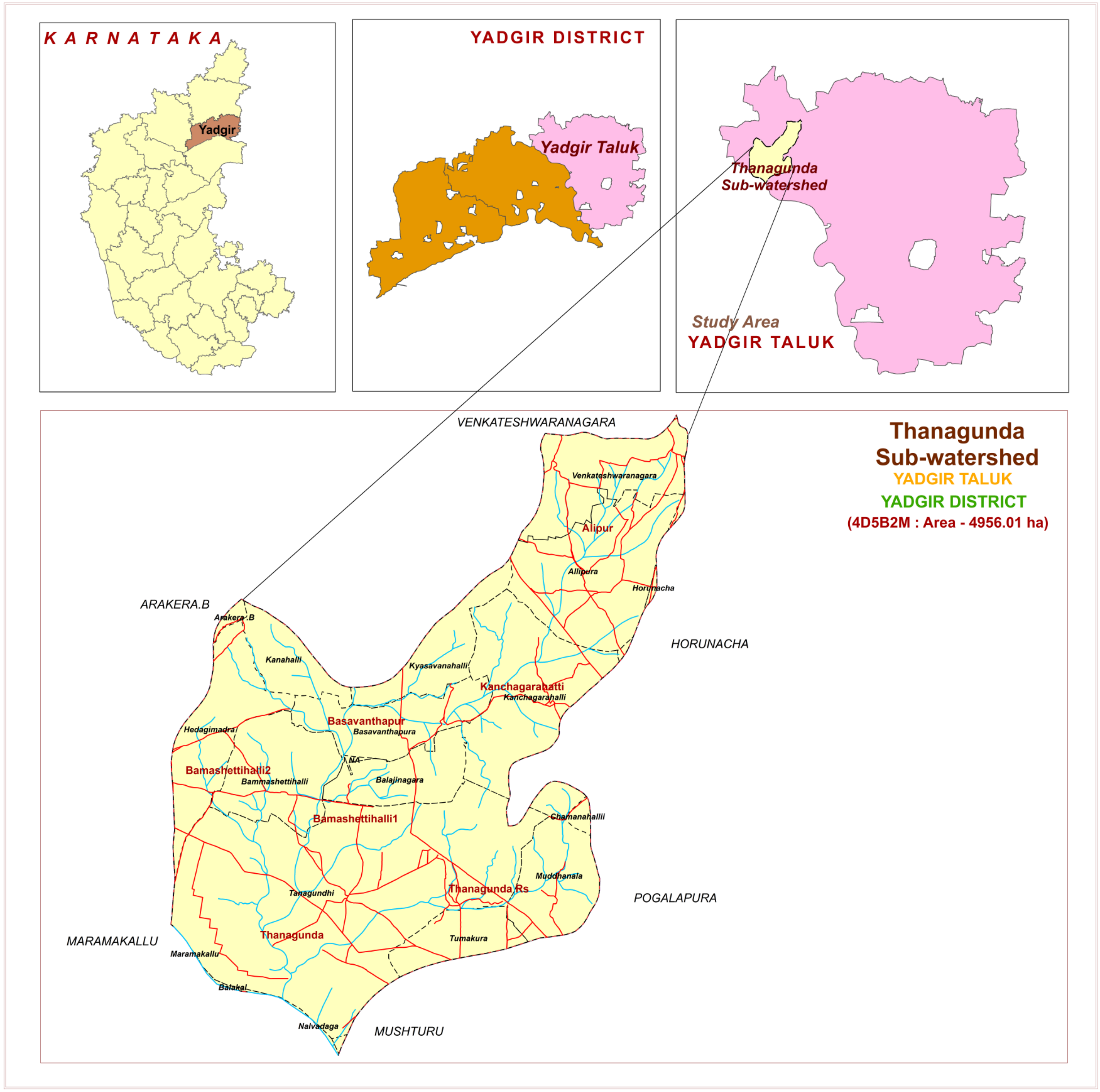
2. General Description of Sub-watershed

The Yadgir, popularly called as “Yadavagiri” by the local people, district came to existence on 30th Dec 2009 by carving out of erst-while Kalaburagi district of Karnataka with a geographical area of 5234.4 square kilometers, located in the northern part of the state. It lies between north latitudes’ $16^0$57’ – $16^0$59’ and east longitudes 77^0 12’ – 77^0 13’. The climate of the district is very hot and dry. The district has an average annual rainfall of 636 mm. Soils are well drained red sandy loam to medium deep black soils. This may be the weathering product of gneissic and granite terrain. Agriculture in Yadgir district is dependent upon rainfall, irrigation tanks, wells, streams etc. The major agricultural crops grown are Jowar, Groundnut, Cotton, Red gram, Bengal gram etc.

As a pilot study, **ICAR-NBSS&LUP, Bangalore** carried out the generation of Sub-watershed (SWs) - LRI for the Thanagunda SWs in Yadgir taluk, Yadgir district. It was selected for data base generation under Sujala III project. Thanagunda Sub-watershed (code– 4D5B2M) is covering an area of 4956.01 ha, bounded by Venkateshwaranagara, Rorunacha, Pogalapura, Mushturu, Maramakallu and Arakera. B villages. This sub-watershed encompasses of 7 MWs namely Alipur (4D5B1B1e), Bamashettihalli-1 (4D5B1B1d), Bamashettihalli-2 (4D5B1B1b), Basavanthapur (4D5B1B1c), Kanchagarahatti (4D5B1B2c), Thanagunda (4D5B1B2a) and Thanagunda Rs (4D5B1B1a). Land Resource Inventory (LRI) was generated for all the seven micro-watersheds.

2.1. Location and Extent

LOCATION MAP OF THANAGUNDA SUB-WATERSHED

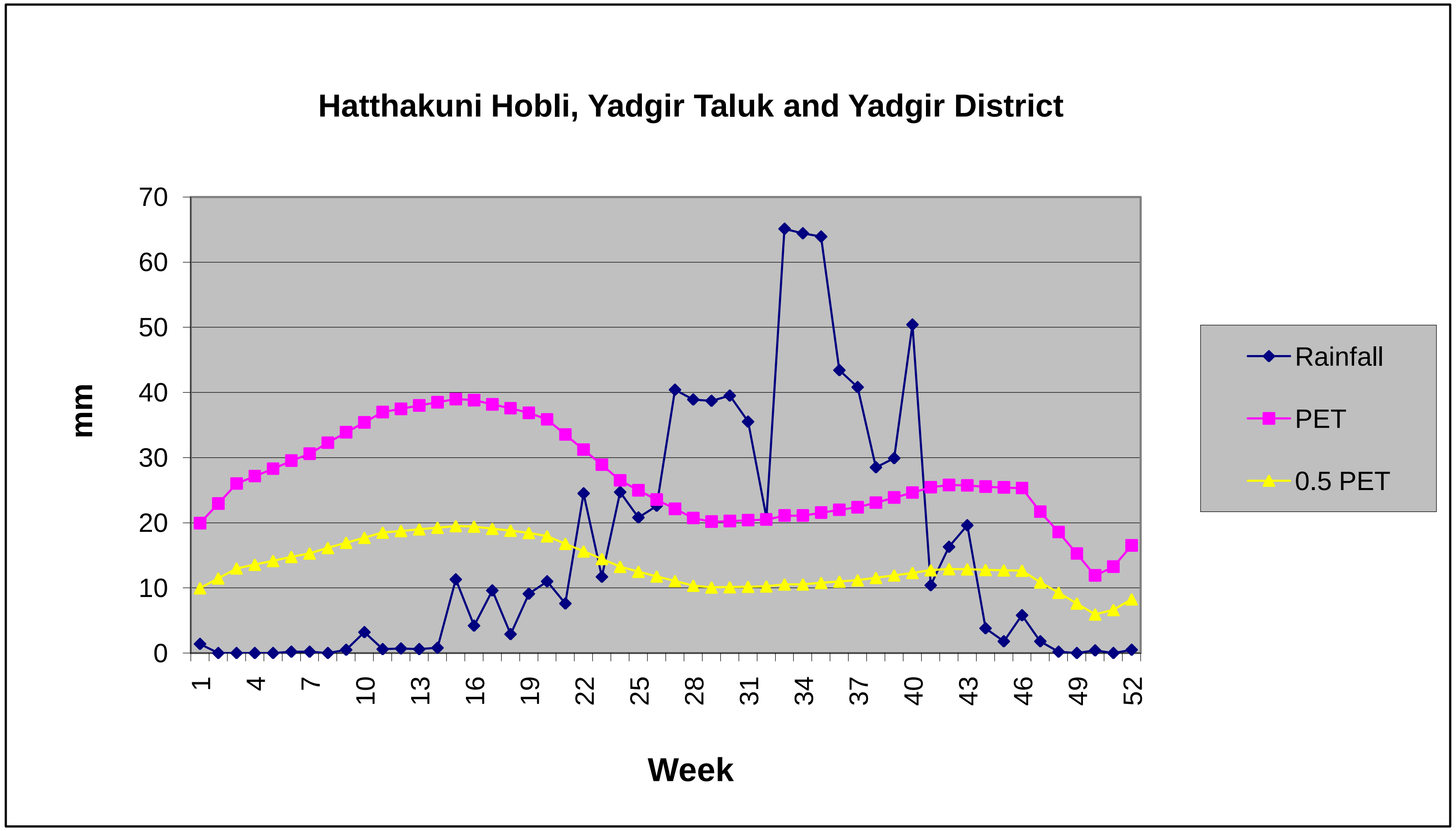


Thanagunda sub-watershed (Yadgir Taluk, Yadgir District) is located between 16^{0}46’15”-16^{0}52’18” North latitudes and 77^{0}1’34”- 77^{0}6’42” East longitudes, covering an area of about 4956.01 ha, bounded by Venkateshwaranagara, Rorunacha, Pogalapura, Mushturu, Maramakallu and Arakera. B villages.

Agro Ecological Sub Region (AESR) 6.2: Central and Western Maharashtra Plateau and North Karnataka Plateau and North Western Telangana Plateau, hot moist semi-arid ESR with shallow and medium loamy to clayey Black soils (medium and deep clayey Black soils as inclusion), medium to high AWC and LGP 120-150 days.

Agro-climatic Zone 2: North-eastern Dry Zone: The total geographic area of this zone is about 1.76 M ha covering 8 taluks of Gulbarga district and 3 taluks of Raichur. Net cultivated area in the zone is about 1.31 M ha of which about 0.09 M ha are irrigated. The mean elevation of the zone is 300-450 m MSL. The main soil type is deep to very deep soils with small pockets of shallow to medium black soils. The zone is cropped predominantly during rabi due to insufficient rainfall (465-785 mm). The principal crops of the zone are jowar, bajra, oilseeds, pulses, cotton and sugarcane.

Climate

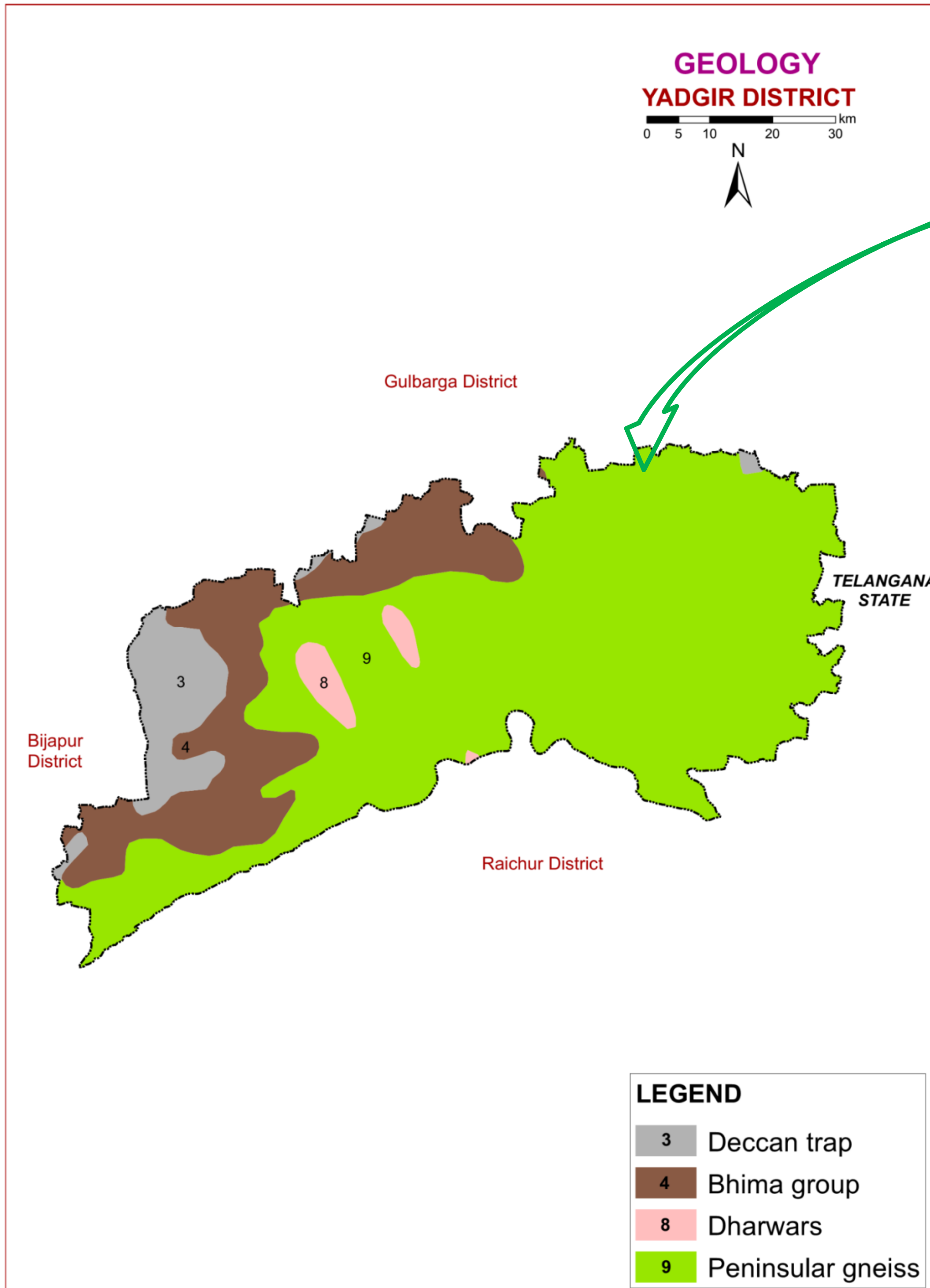


Length of Growing Period (LGP) is varying from June 1st week to 3rd week of October (120 - 150 days)

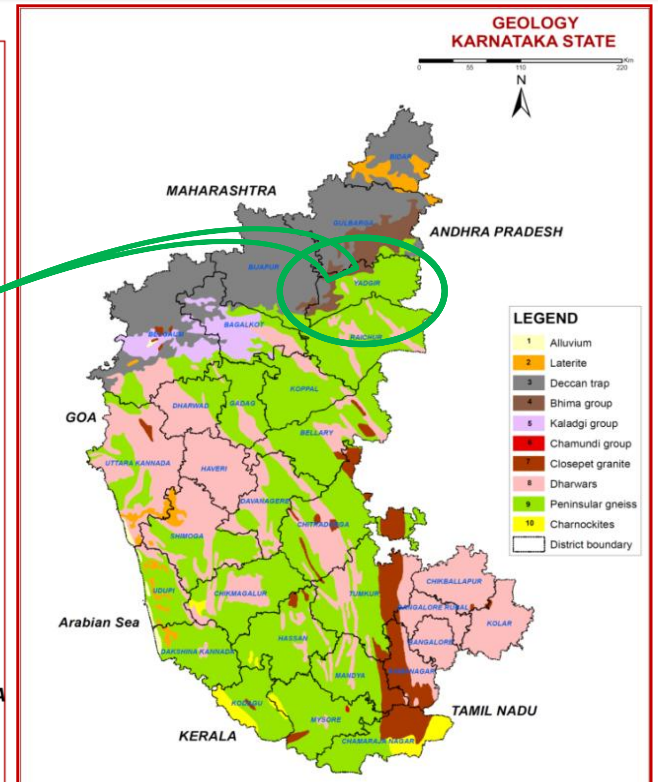
Annual Rainfall : 829 mm. in the Hatthakuni Hobli, Yadgir Taluk & District

Source: KSNDMC (1980-2011)

2.3. Geology



Source: Geological Survey of India, 1981



Source: Geological Survey of India, 1981

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 - YADGIR DISTRICT

Mesozoic Group

Towards the end of the Cretaceous Period there was tremendous volcanic activity in the Peninsular part of India with eruption of a series of lava flows which came out through fissures and cracks. This formation is Known as the Deccan Trap.

Deccan Trap: The Deccan Trap covers an area of 25,000 sq. km. Eight lava flows have been identified in Karnataka, horizontally overlying the older formations. The thickness of the individual flows averages about five metres. The Deccan Trap is relatively uniform in petrographic character. The most common type is augite basalt. Dominant colour is greyish green; texture ranges from cryptocrystalline to glassy. The rock is often visicular and scoriaceous.

Upper Proterozoic Group

Formations of the Upper Proterozoic in Karnataka are closepet granites, Chamundi granites, Kaladgi series and Bhima series.

Bhima series

This series, equivalent to the Kurnool formations, is named after the Bhima river and occurs in Bijapur and Gulbarga districts. It covers an area of about 4200 sq. km and is overlain by the Deccan trap. The group consists of horizontal, unfossiliferous, unmetamorphosed sedimentary rocks such as sandstones, green, purple and black shales, and cream and bluish limestones. The thickness is about 477 metres.

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.

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.

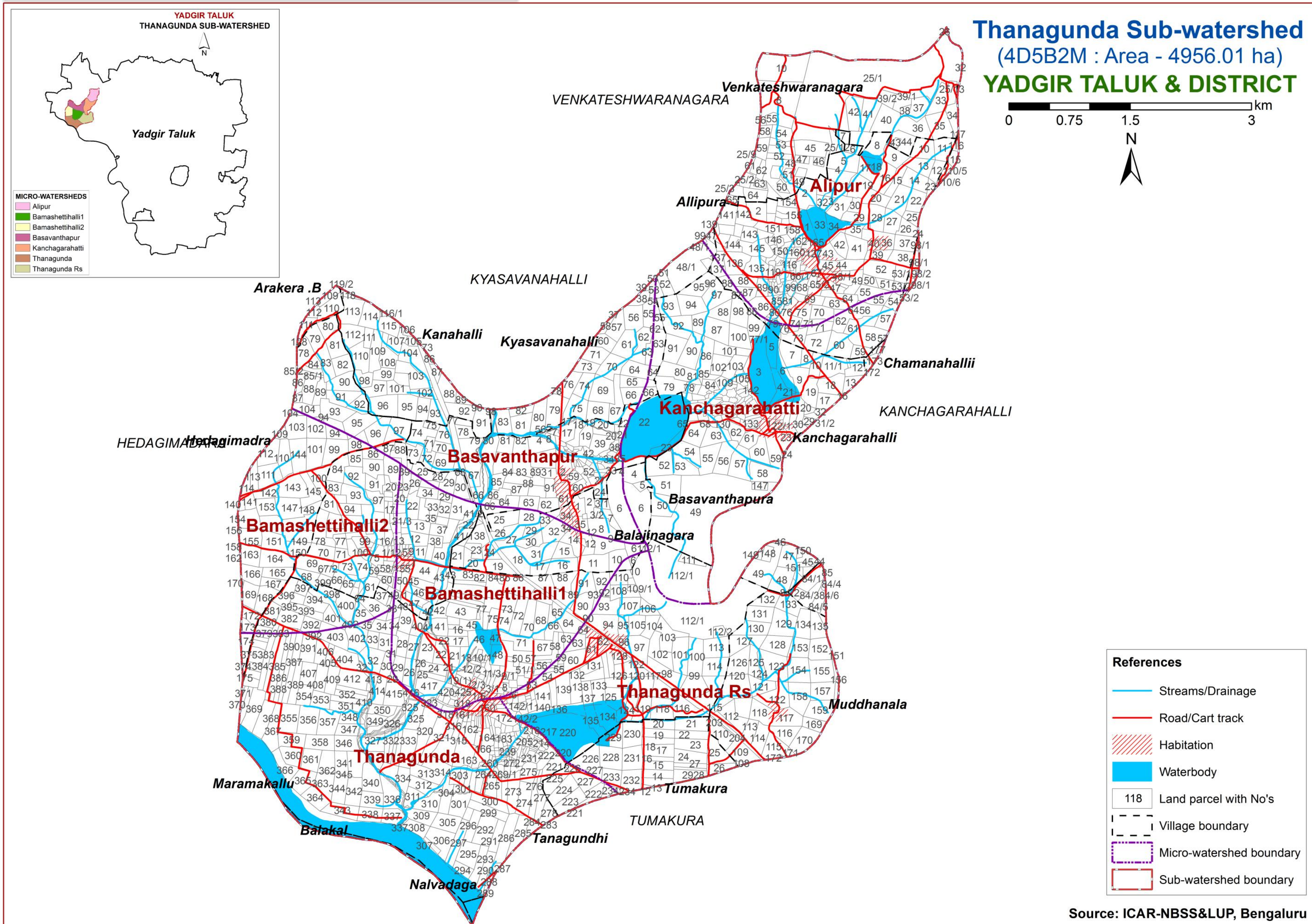
3. Survey Methodology

Sequence of activities in generation of LRI

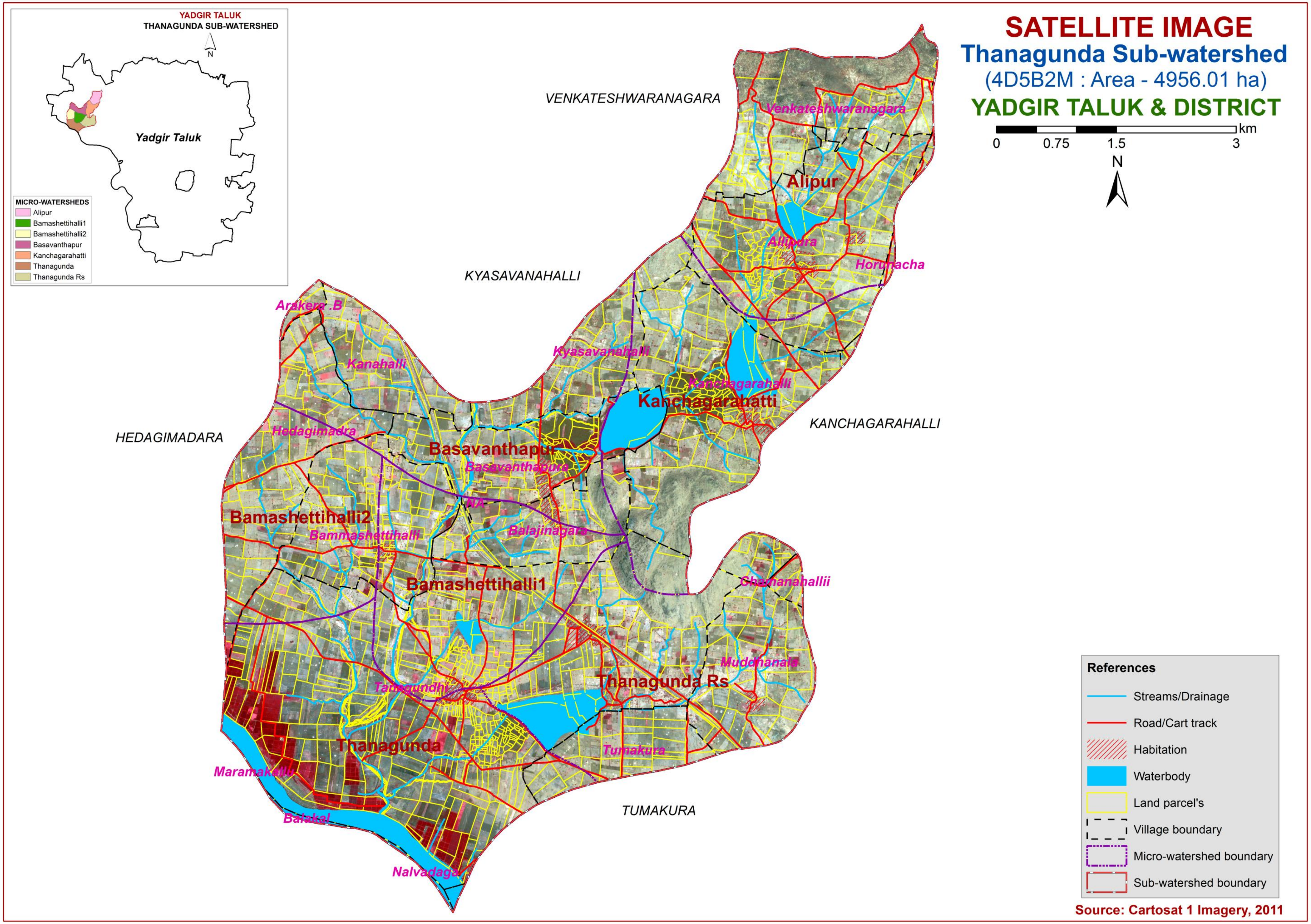
- Traversing the watershed using cadastral maps and imagery as base
- Identifying landforms, geology, land use and other features
- Selecting fields representing land units
- Opening profiles to 2 m depth
- Studying soil and site characteristics
- Grouping similar areas based on their soil-site characteristics 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.

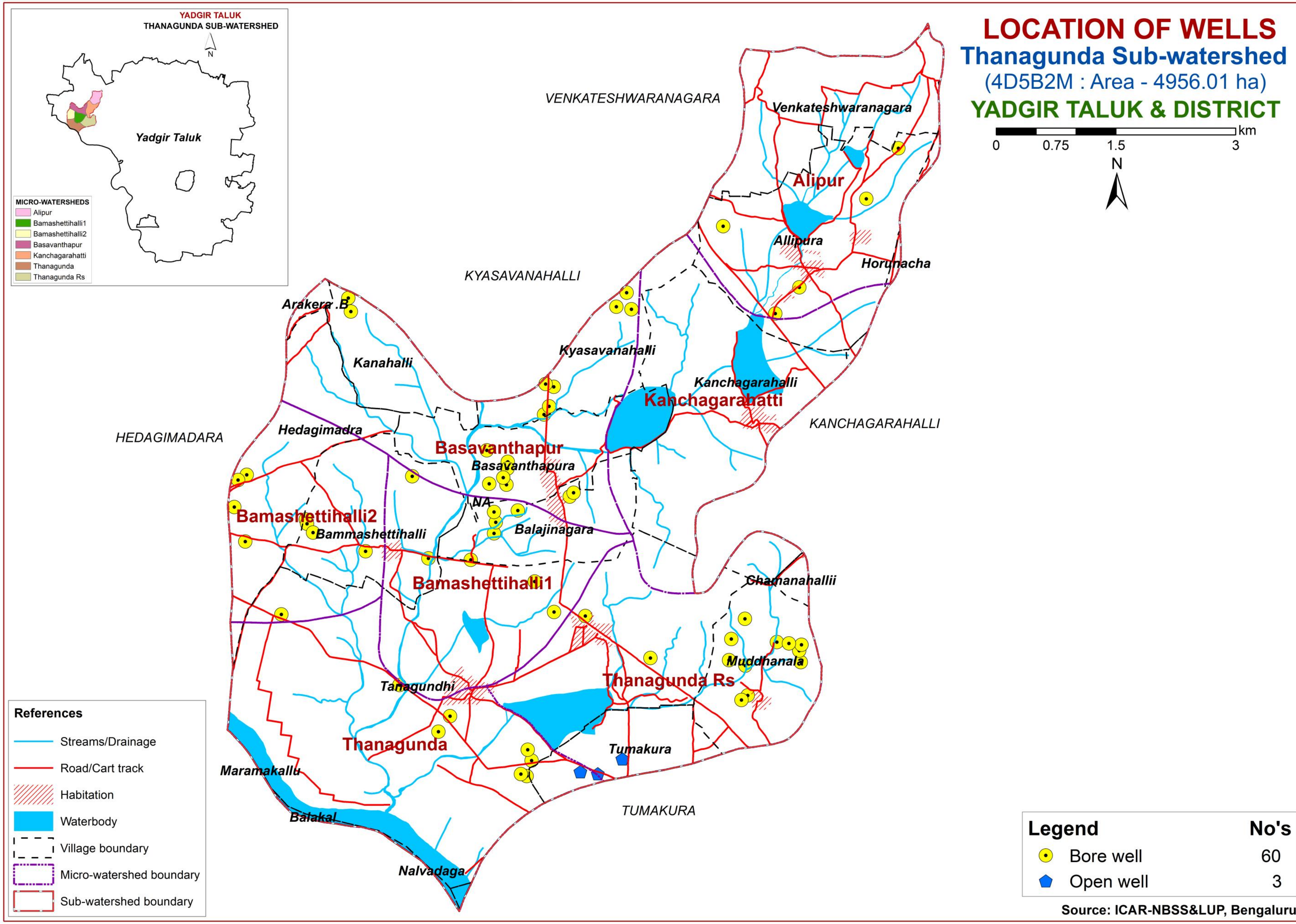
3.1. Database Used - Cadastral map

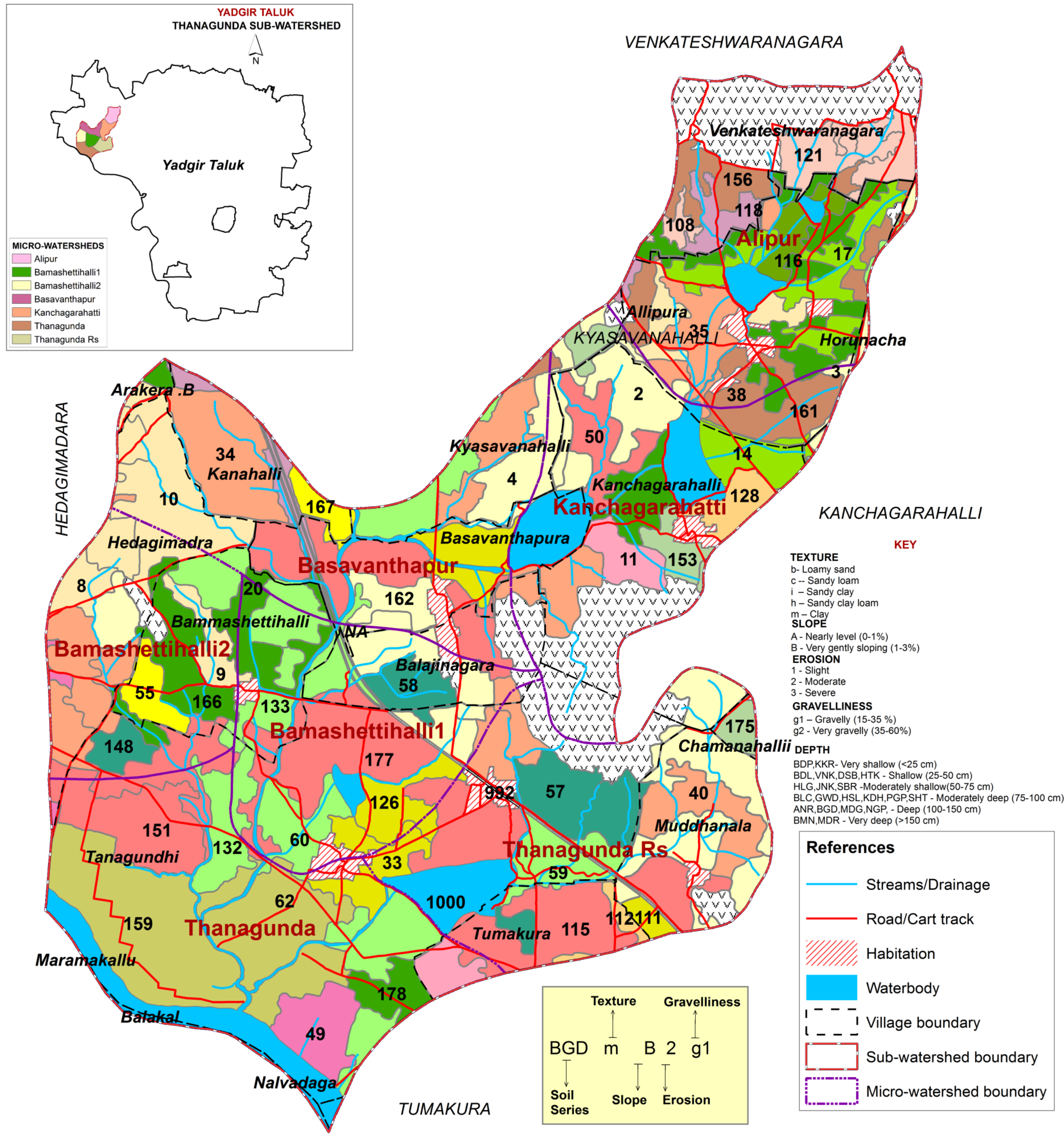


3.2. Database Used - Satellite Image



3.3. Location of Wells





SOIL

Thanagunda Sub-watershed

(4D5B2M : Area - 4956.01 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

N

Soil Phase	Area in ha (%)	Soil Phase	Area in ha (%)
Soil of Granite and Granite Gneiss Landscape			
2, BDLbB2	229 (4.61)	62, BMNmB2	154 (3.1)
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55, ANRiB2	31 (0.62)	177, BGDiA1	154 (3.1)
167, ANRcA1	22 (0.45)	153, KKRbB2g1	46 (0.93)
57, MDGcB2	96 (1.93)	175, KKRcB2	17 (0.35)
58, MDGiB2	40 (0.81)	156, HTKbB2	53 (1.07)
148, MDGhB2	24 (0.48)	161, HTKbB2g1	55 (1.11)
59, MDRcB2	106 (2.14)	20, JNKcB2	220 (4.44)
60, MDRiA1	101 (2.04)	166, JNKcA1	63 (1.26)
132, MDRhB2	177 (3.57)	178, JNKbB2g2	33 (0.66)
133, MDRiB2	46 (0.93)		
Low Land		Rock outcrops	422 (8.51)
116, KDHiB2	30 (0.61)	Others*	392 (7.92)
Railway	18 (0.36)		

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

4.1 Mapping unit description of Thanagunda (4D5B2M) Sub-watershed in Yadgir Taluk, Yadgir district

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite gneiss Landscape				
	BMN	Bhimanahalli soils are very deep (>150 cm), moderately well drained, have very dark gray, calcareous cracking clay black soils occurring on very gently sloping uplands under cultivation		**359 (7.2)**
159		BMNmA1	Clay surface, slope 0-1%, slight erosion	205 (4.13)
62		BMNmB2	Clay surface, slope 1-3%, moderate erosion	154 (3.1)
	MDR	Madhwara soils are very deep (>150 cm), well drained, have very dark gray to very dark brown, slightly calcareous sandy clay loam soils occurring on nearly level to very gently sloping uplands under cultivation		**430 (8.6)**
59		MDRcB2	Sandy loam surface, slope 1-3%, moderate erosion	106 (2.14)
132		MDRhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	177 (3.57)
60		MDRiA1	Sandy clay surface, slope 0-1%, slight erosion	101 (2.04)
133		MDRiB2	Sandy clay surface, slope 1-3%, moderate erosion	46 (0.93)
	ANR	Anur soils are deep (100-150 cm), moderately well drained, have dark gray to dark brown, calcareous sodic clay soils occurring on very gently to gently sloping uplands under cultivation		**53 (1.07)**
167		ANRcA1	Sandy loam surface, slope 0-1%, slight erosion	22 (0.45)
55		ANRiB2	Sandy clay surface, slope 1-3%, moderate erosion	31 (0.62)
	BGD	Belagundi soils are deep (100-150 cm) well drained, have brown to dark yellowish brown, slightly calcareous clayey soils occurring on nearly level to very gently sloping uplands under cultivation		**701 (14)**
50		BGDbB2	Loamy sand surface, slope 1-3%, moderate erosion	55 (1.12)
177		BGDiA1	Sandy clay surface, slope 0-1%, slight erosion	154 (3.1)
115		BGDmB2	Clay surface, slope 1-3%, moderate erosion	388 (7.82)
151		BGDmB2g1	Clay surface, slope 1-3%, moderate erosion, gravelly (15-35%)	104 (2.1)
	MDG	Mundargi soils are deep (100-150 cm), well drained, have brown to dark yellowish brown, sandy clay loam soils occurring on very gently sloping uplands under cultivation		**160 (3.2)**
57		MDGcB2	Sandy loam surface, slope 1-3%, moderate erosion	96 (1.93)
148		MDGhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	24 (0.48)
58		MDGiB2	Sandy clay surface, slope 1-3%, moderate erosion	40 (0.81)
	NGP	Nagalapur soils are deep (100-150 cm), moderately well drained, have very dark gray to very dark grayish brown, black calcareous cracking clay soils occurring on very gently sloping uplands under cultivation		**64 (1.3)**
49		NGPmB2	Clay surface, slope 1-3%, moderate erosion	64 (1.3)
	BLC	Balichakra soils are moderately deep (75-100 cm), well drained, have reddish brown to dark reddish brown, sandy clay loam red soils occurring on very gently sloping uplands under cultivation		**64 (1.28)**
38		BLCiB2	Sandy clay surface, slope 1-3%, moderate erosion	64 (1.28)

To be continued….

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite gneiss Landscape				
	GWD	Gowdagera soils are moderately deep (75-100 cm), moderately well drained, have dark grayish brown to very dark grayish brown, calcareous sodic sandy clay loam soils occurring on very gently sloping uplands under cultivation		**313 (6.1)**
34		GWDcB2	Sandy loam surface, slope 1-3%, moderate erosion	202 (4.07)
35		GWDiB2	Sandy clay surface, slope 1-3%, moderate erosion	111 (2.24)
	HSL	Hosalli soils are moderately deep (75-100 cm), moderately well drained, have yellowish brown to dark yellowish brown, slightly calcareous sandy clay soils occurring on very gently sloping uplands under cultivation		**162 (3.2)**
111		HSLbB2	Loamy sand surface, slope 1-3%, moderate erosion	12 (0.24)
126		HSLhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	99 (1.99)
33		HSLiB2	Sandy clay surface, slope 1-3%, moderate erosion	52 (1.04)
	PGP	Poglapur soils are moderately deep (75-100 cm), well drained, have dark brown, dark reddish brown to yellowish red sandy clay soils occurring on very gently sloping uplands under cultivation		**177 (3.56)**
40		PGPcB2	Sandy loam surface, slope 1-3%, moderate erosion	177 (3.56)
	SHT	Shettalli soils are moderately deep (75-100 cm), well drained, have very dark gray, slightly calcareous gravelly sandy clay soils occurring on very gently sloping uplands under cultivation		**44 (0.89)**
128		SHTcB2	Sandy loam surface, slope 1-3%, moderate erosion	33 (0.66)
112		SHTmB2	Clay surface, slope 1-3%, moderate erosion	11 (0.23)
	HLG	Halagera soils are moderately shallow (50-75 cm), well drained, have very dark grayish brown to dark yellowish brown, calcareous sandy clay loam soils occurring on very gently sloping uplands under cultivation.		**135 (2.7)**
14		HLGbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	48 (0.96)
17		HLGiB2	Sandy clay surface, slope 1-3%, moderate erosion	87 (1.75)
	JNK	Jinkera soils are moderately shallow (50-75 cm), well drained, have dark brown to very dark grayish brown, slightly calcareous sandy clay loam soils occurring on very gently sloping uplands under cultivation		**315 (6.3)**
178		JNKbB2g2	Loamy sand surface, slope 1-3%, moderate erosion, very gravelly (35-60%)	33 (0.66)
166		JNKcA1	Sandy loam surface, slope 0-1%, slight erosion	63 (1.26)
20		JNKcB2	Sandy loam surface, slope 1-3%, moderate erosion	220 (4.44)
	SBR	Sambara soils are moderately shallow (50-75 cm), somewhat excessively drained, have light gray to pink, loamy sand soils occurring on very gently to gently sloping uplands under cultivation		**61 (1.23)**
11		SBRcB2	Sandy loam surface, slope 1-3%, moderate erosion	61 (1.23)

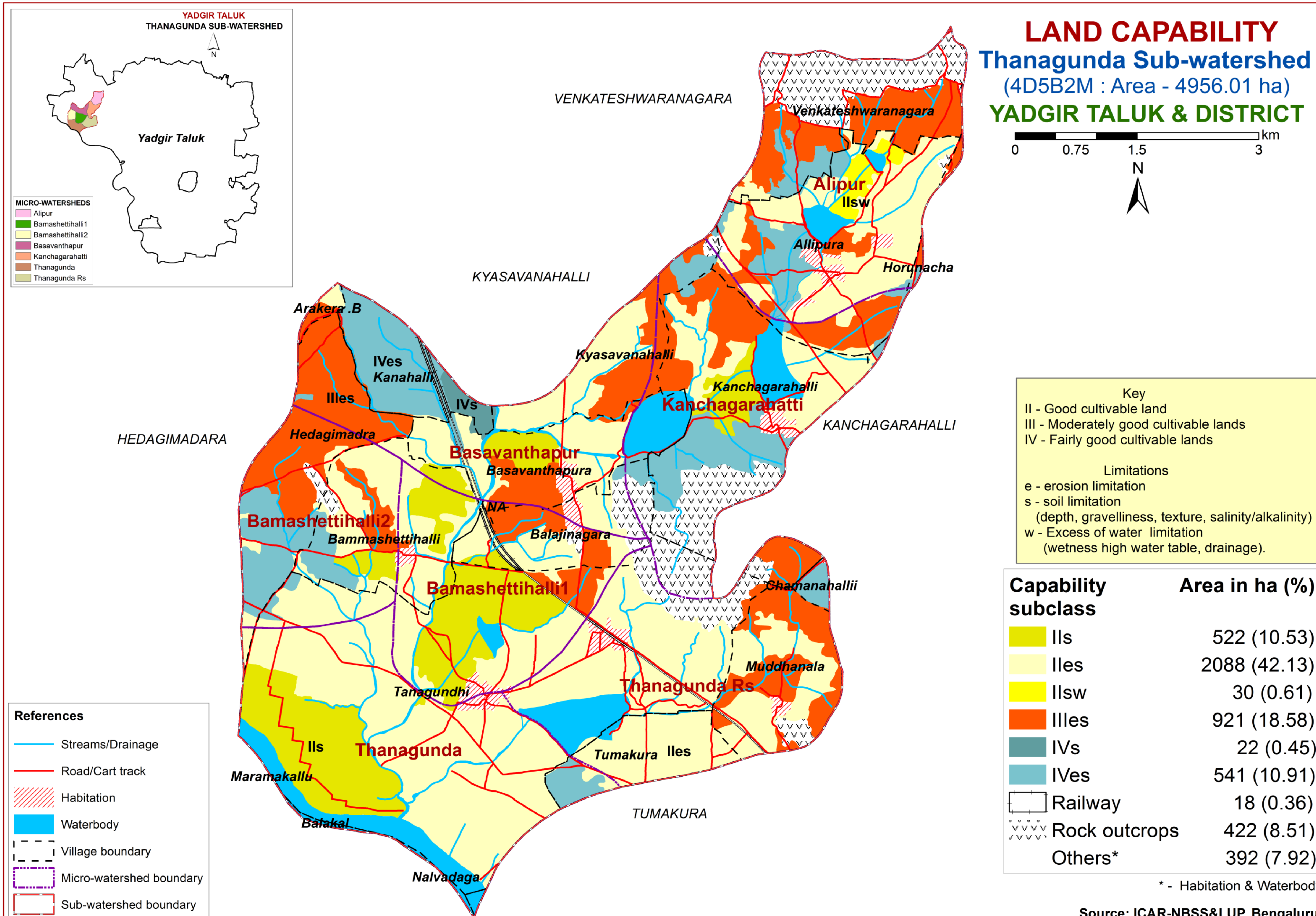
To be continued….

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
Soils of Granite and Granite gneiss Landscape				
	BDL	Badiyala soils are shallow (25-50 cm), well drained, have dark brown to very dark brown and dark yellowish brown, slightly calcareous sandy loam soils occurring on very gently to gently sloping uplands under cultivation		**472 (9.5)**
2		BDLbB2	Loamy sand surface, slope 1-3%, moderate erosion	229 (4.61)
3		BDLbC3	Loamy sand surface, slope 3-5%, severe erosion	11 (0.21)
4		BDLhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	168 (3.39)
162		BDLhB2g1	Sandy clay loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	65 (1.31)
	DSB	Dastharabad soils are shallow (25-50 cm), well drained, have dark brown to very dark brown, gravelly clay soils occurring on very gently to gently sloping uplands under cultivation		**93 (1.8)**
121		DSBcB2	Sandy loam surface, slope 1-3%, moderate erosion	82 (1.66)
108		DSBiB2	Sandy clay surface, slope 1-3%, moderate erosion	11 (0.22)
	HTK	Hattikuni soils are shallow (25-50 cm), well drained, have dark yellowish brown sandy loam soils occurring on very gently sloping uplands under cultivation		**108 (2.2)**
156		HTKbB2	Loamy sand surface, slope 1-3%, moderate erosion	53 (1.07)
161		HTKbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	55 (1.11)
	VNK	Vanakanahalli soils are shallow (25-50 cm), well drained, have dark reddish brown, sandy clay red soils occurring on very gently to moderately sloping uplands under cultivation		**258 (5.2)**
8		VNKbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	25 (0.49)
9		VNKcB2	Sandy loam surface, slope 1-3%, moderate erosion	92 (1.86)
10		VNKiB2	Sandy clay surface, slope 1-3%, moderate erosion	142 (2.86)
	BDP	Baddeppalli soils are very shallow (<25 cm), well drained, have dark brown to dark reddish brown, calcareous sandy clay loam soils occurring on very gently sloping uplands under cultivation		**62 (1.25)**
118		BDPcB2	Sandy loam surface, slope 1-3%, moderate erosion	62 (1.25)
	KKR	Kakalawar soils are very shallow (<25 cm), well drained, have dark brown sandy loam soils occurring on very gently sloping uplands under cultivation		**63 (1.28)**
153		KKRbB2g1	Loamy sand surface, slope 1-3%, moderate erosion, gravelly (15-35%)	46 (0.93)
175		KKRcB2	Sandy loam surface, slope 1-3%, moderate erosion	17 (0.35)
	KDH	Kadechoor soils are moderately deep (75-100 cm), moderately well drained, have very dark grayish brown to dark brown, slightly calcareous sandy clay soils occurring on very gently to gently sloping lowlands under cultivation		**30 (0.61)**
116		KDHiB2	Sandy clay surface, slope 1-3%, moderate erosion	30 (0.61)
992		Railway	Railway line	**18 (0.36)**
999		Rock outcrops	Rock lands, both massive and bouldery with little or no soil	**422 (8.51)**
1000		Others	Habitation and Waterbody	**392 (7.92)**

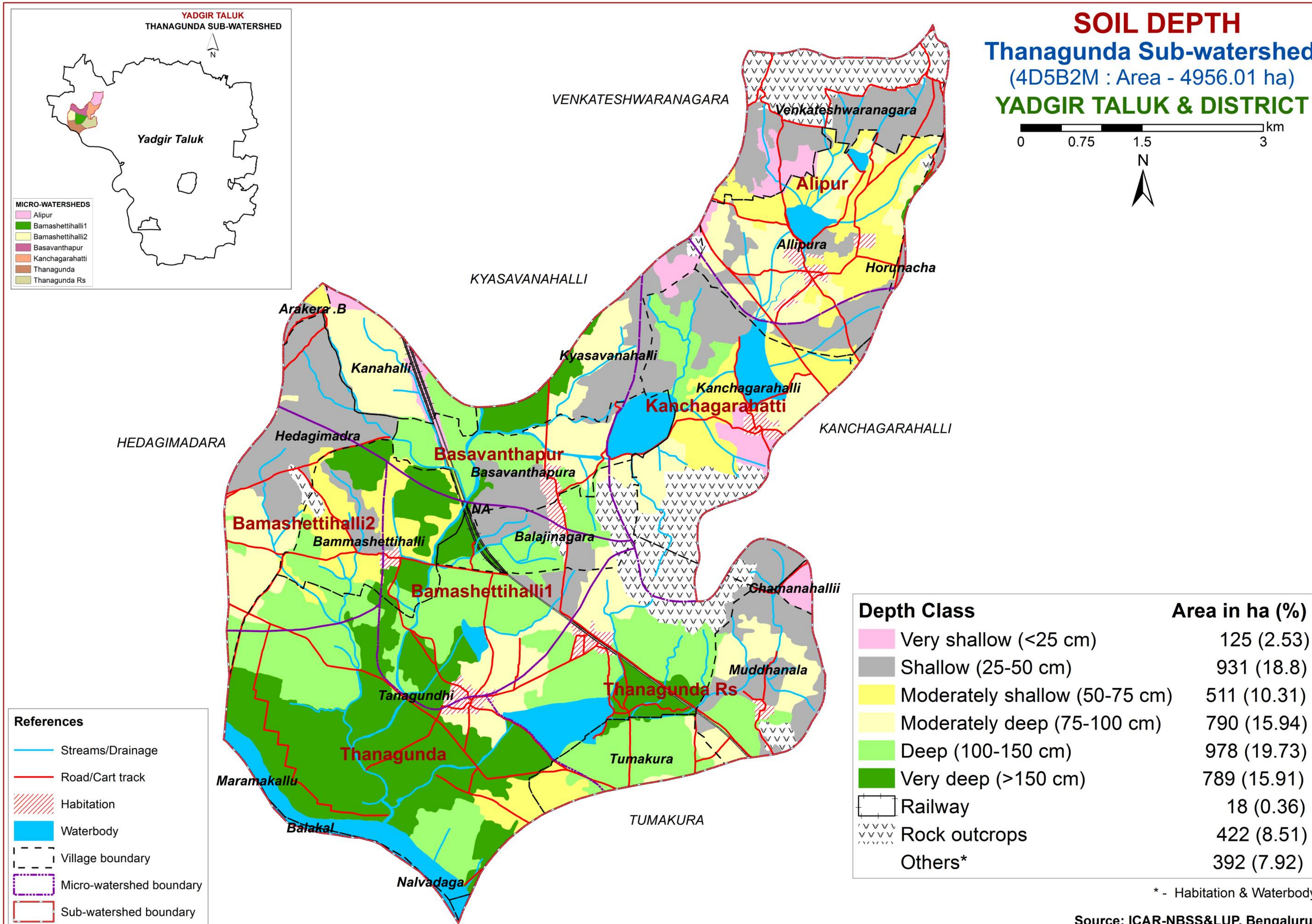
* Soil map unit numbers are continuous for the taluk, not for the sub-watershed

5. Soil Survey Interpretations

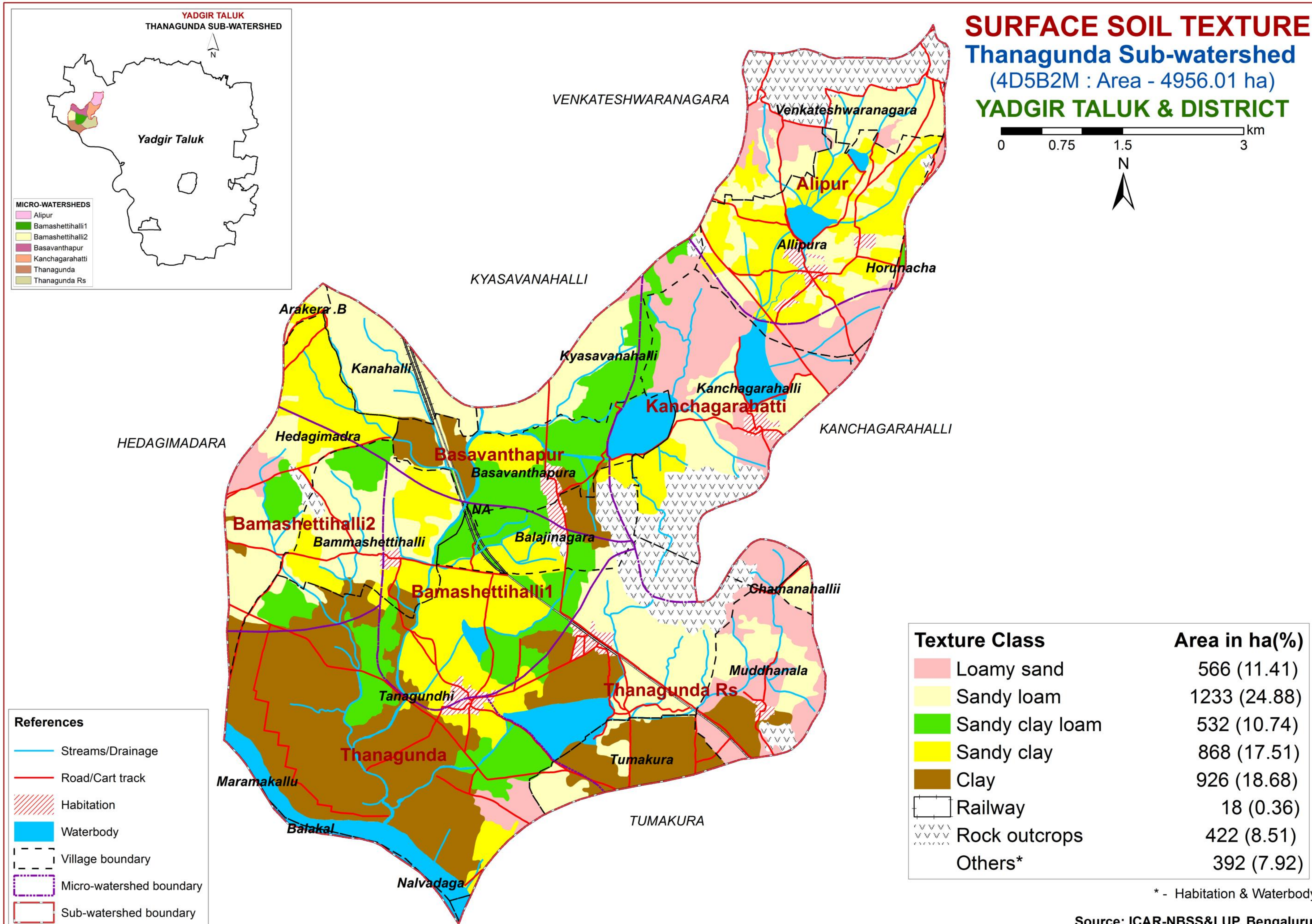
5.1. Land Capability Classification



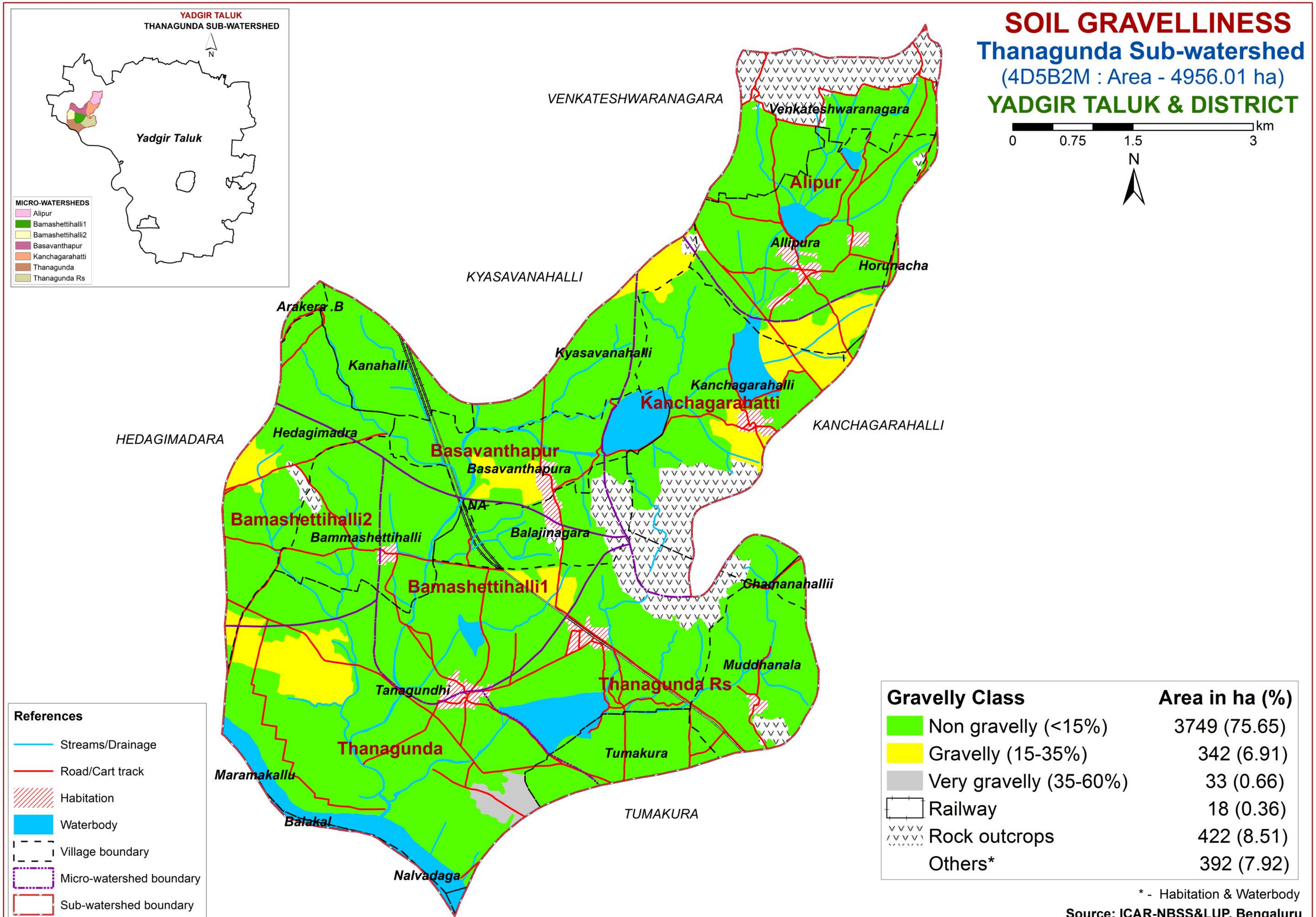
5.2. Soil Depth



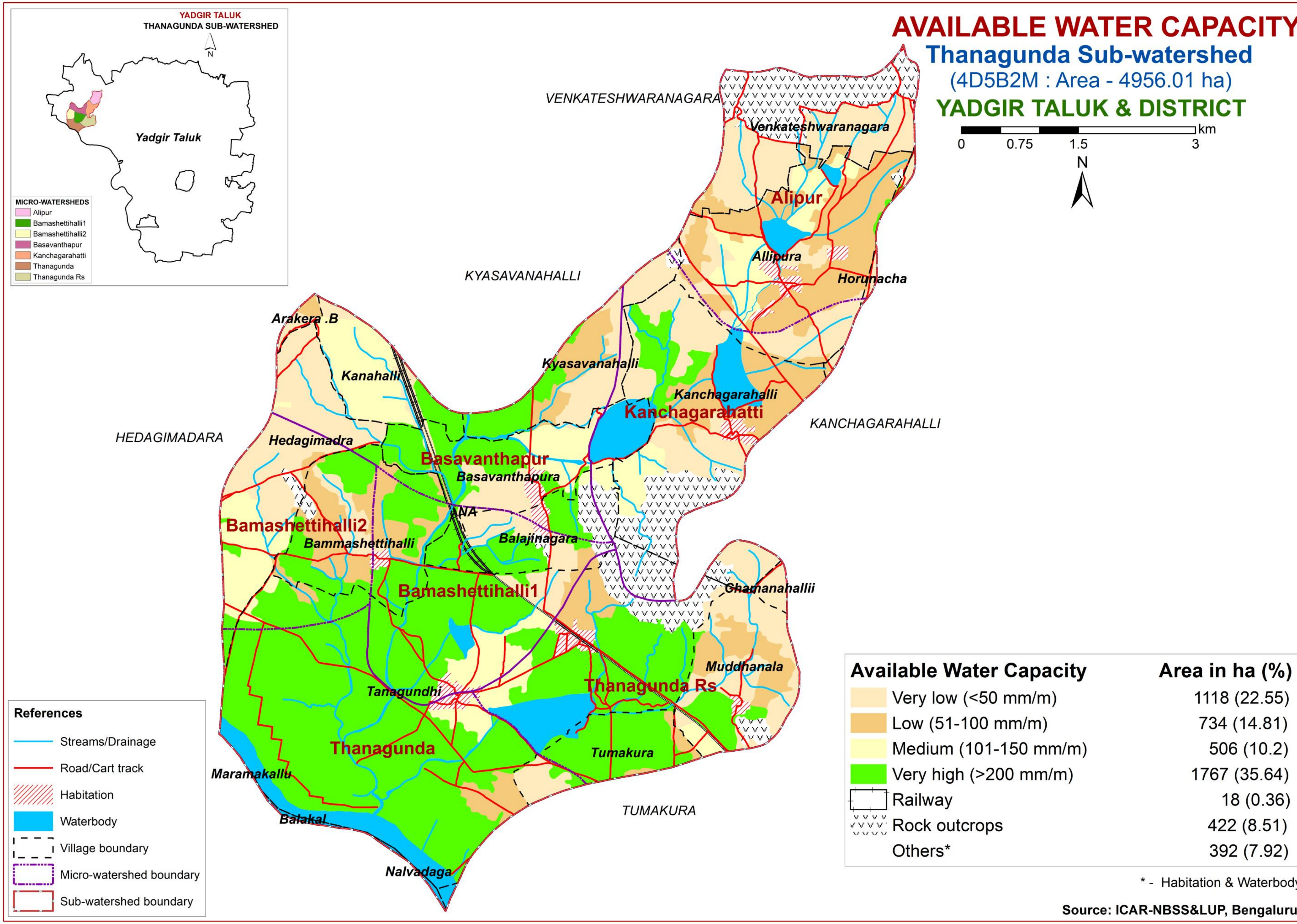
5.3. Surface Soil Texture



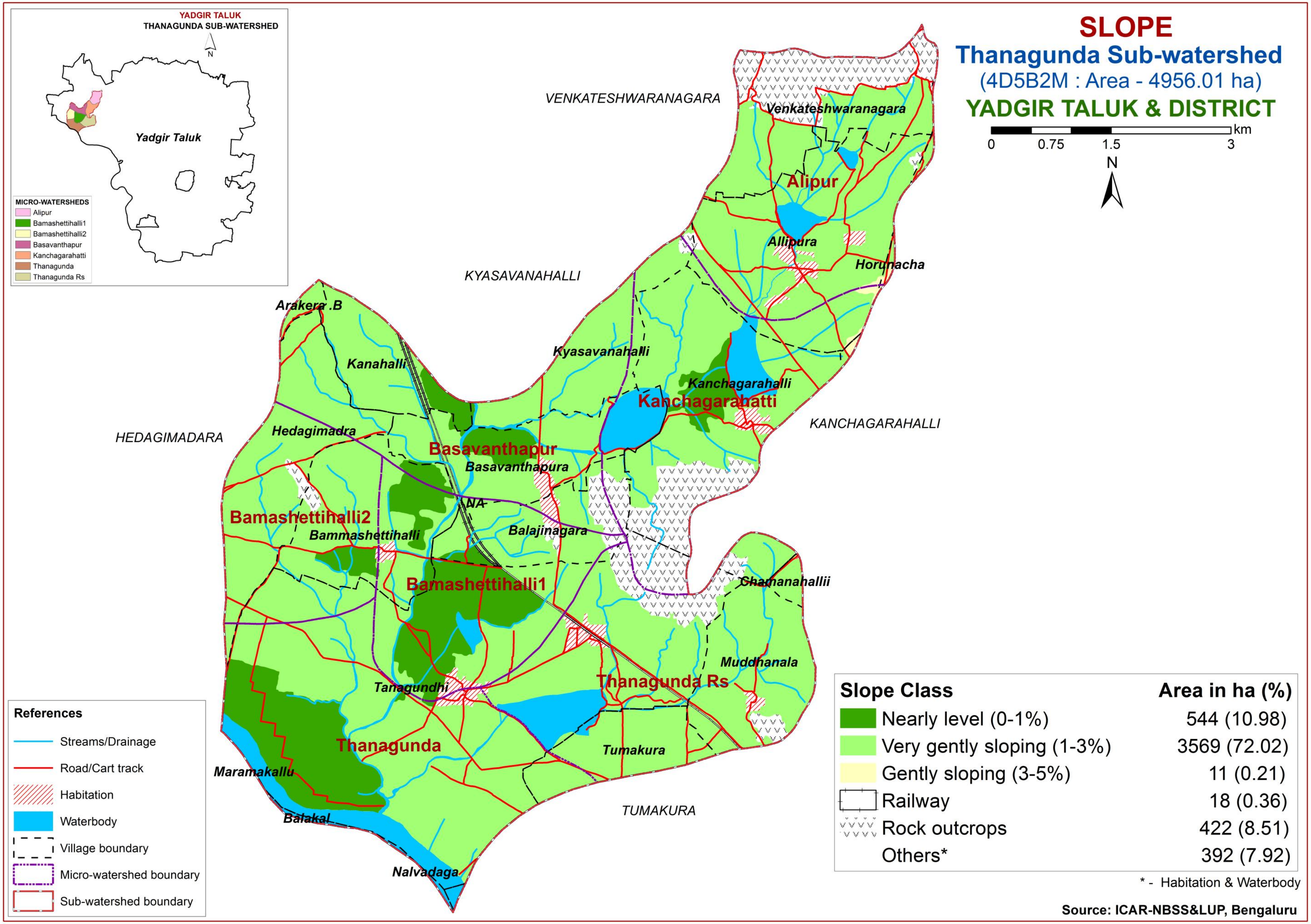
5.4. Surface Soil Gravelliness



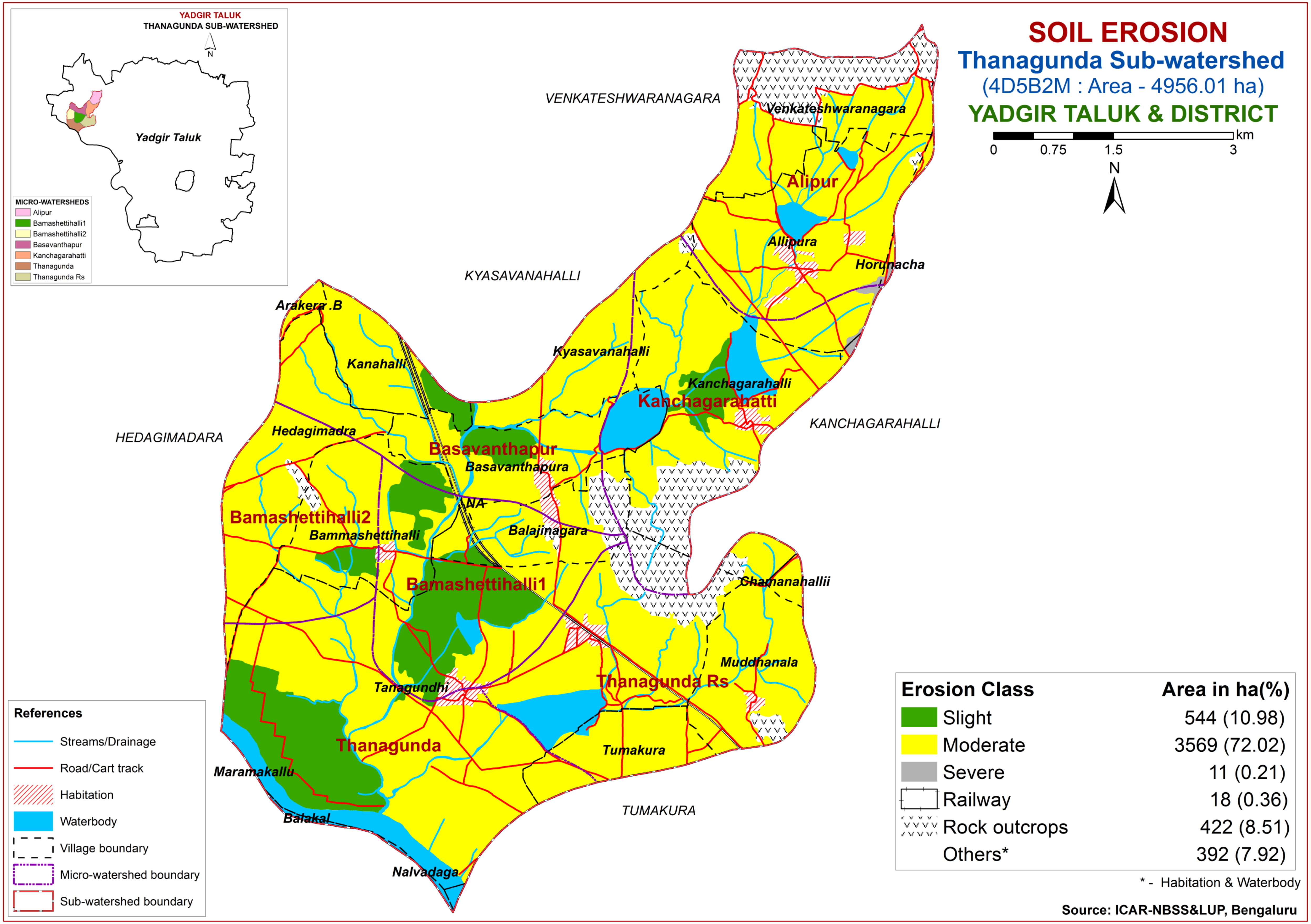
5.5. Available Water Capacity



5.6.Slope

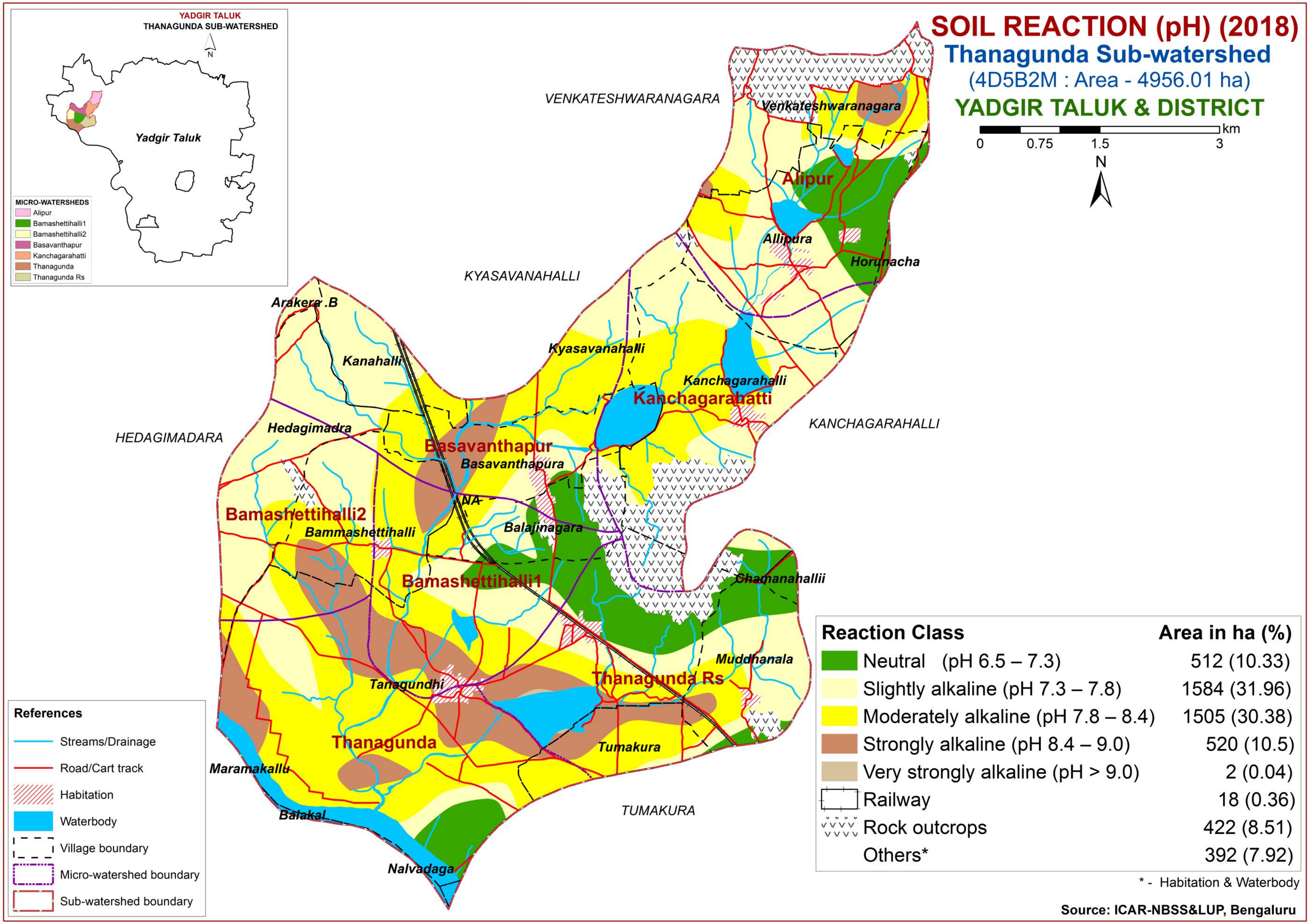

SLOPE
Thanagunda Sub-watershed
(4D5B2M : Area - 4956.01 ha)
YADGIR TALUK & DISTRICT
0 0.75 1.5 3 km
N
YADGIR TALUK
THANAGUNDA SUB-WATERSHED
Yadgir Taluk
MICRO-WATERSHEDS
Alipur
Bamashettihalli1
Bamashettihalli2
Basavanthapur
Kanchagarahatti
Thanagunda
Thanagunda Rs
VENKATESHWARANAGARA
KYASAVANAHALLI
HEDAGIMADARA
KANCHAGARAHALLI
TUMAKURA
Venkateshwaranagara
Alipur
Allipura
Horunacha
Arakera .B
Kanahalli
Kyasavanahalli
Kanchagarahalli
Kanchagarahatti
Hedagimadra
Basavanthapur
Basavanthapura
NA
Bamashettihalli2
Bammashettihalli
Balajinagara
Chamanahallii
Bamashettihalli1
Muddhanala
Tanagundhi
Thanagunda Rs
Thanagunda
Tumakura
Maramakallu
Balakal
Nalvadaga
References
Streams/Drainage
Road/Cart track
Habitation
Waterbody
Village boundary
Micro-watershed boundary
Sub-watershed boundary
Slope Class | Area in ha (%)
Nearly level (0-1%) 544 (10.98)
Very gently sloping (1-3%) 3569 (72.02)
Gently sloping (3-5%) 11 (0.21)
Railway 18 (0.36)
Rock outcrops 422 (8.51)
Others* 392 (7.92)
* - Habitation & Waterbody
Source: ICAR-NBSS&LUP, Bengaluru

5.7.Soil Erosion

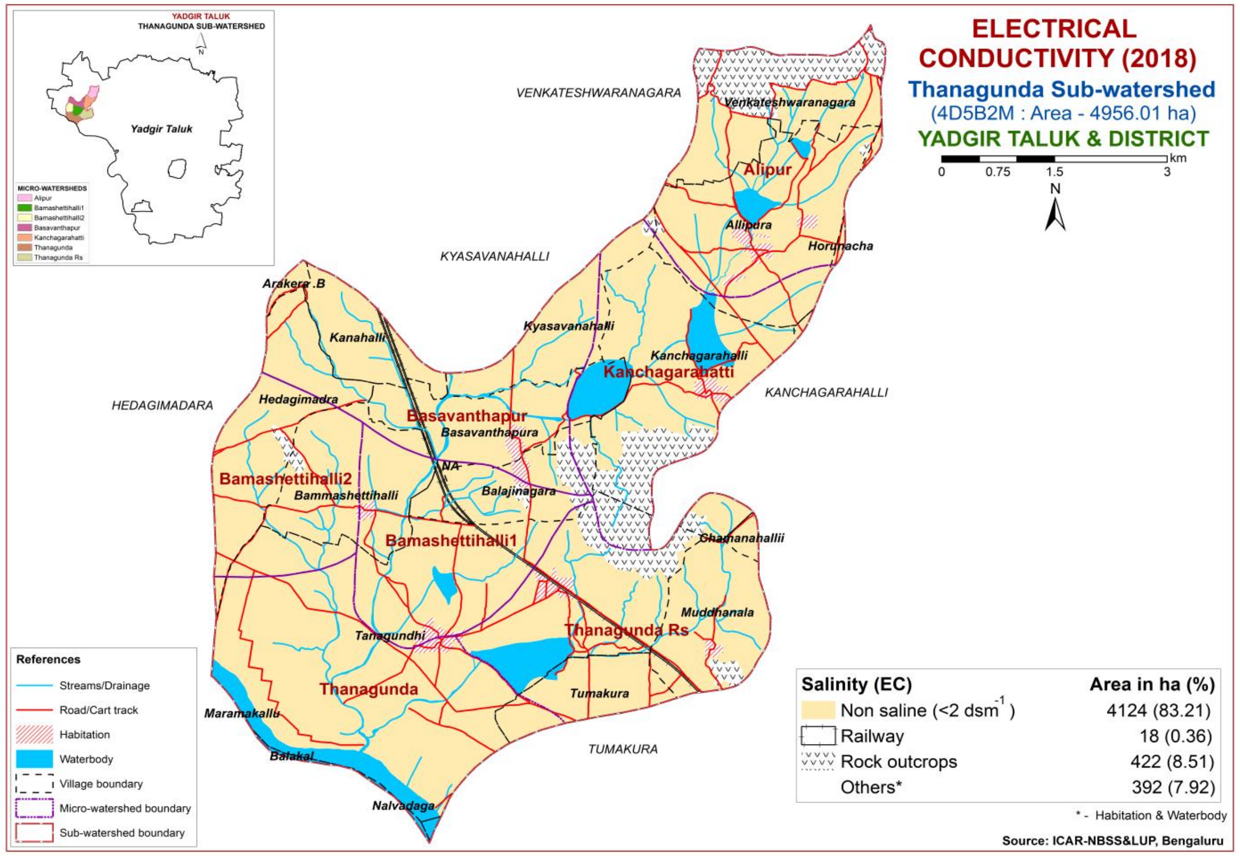


6. Soil Fertility Status

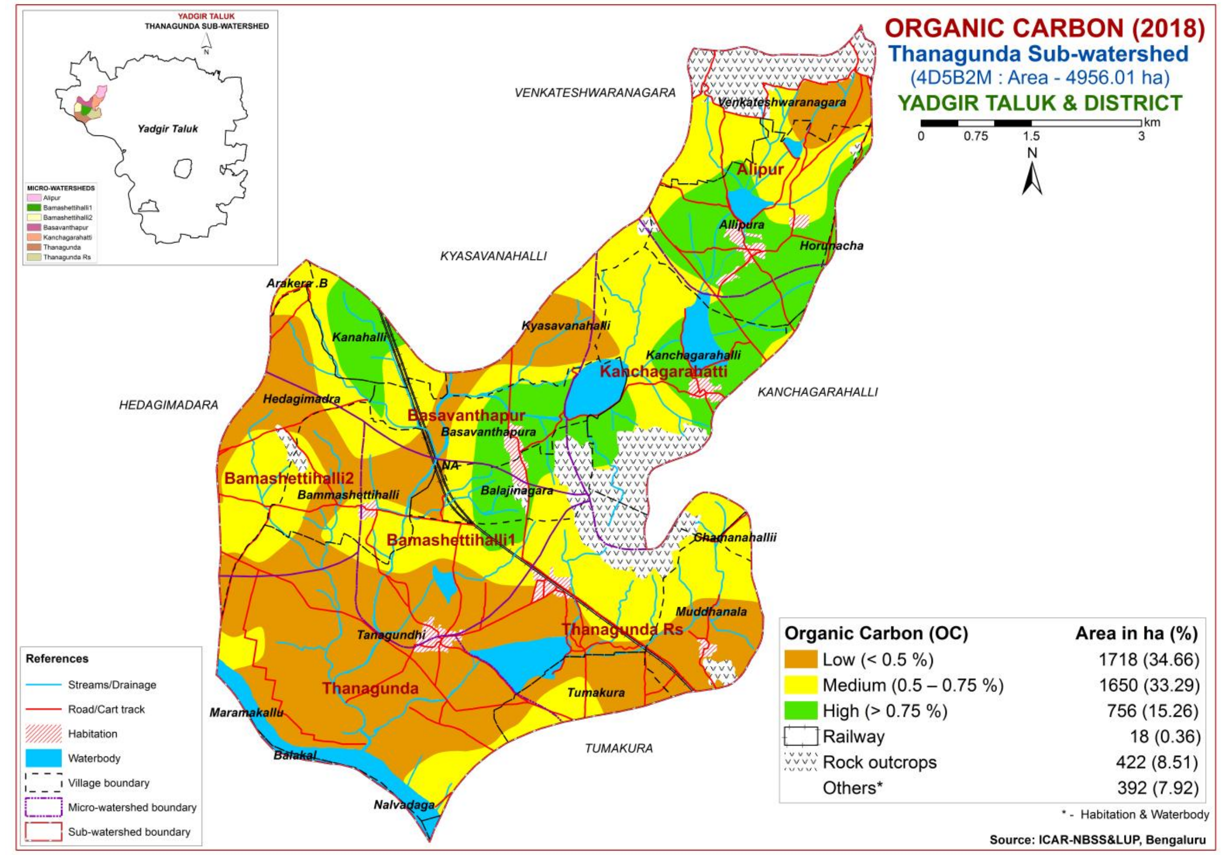
6.1. Soil Reaction (pH)



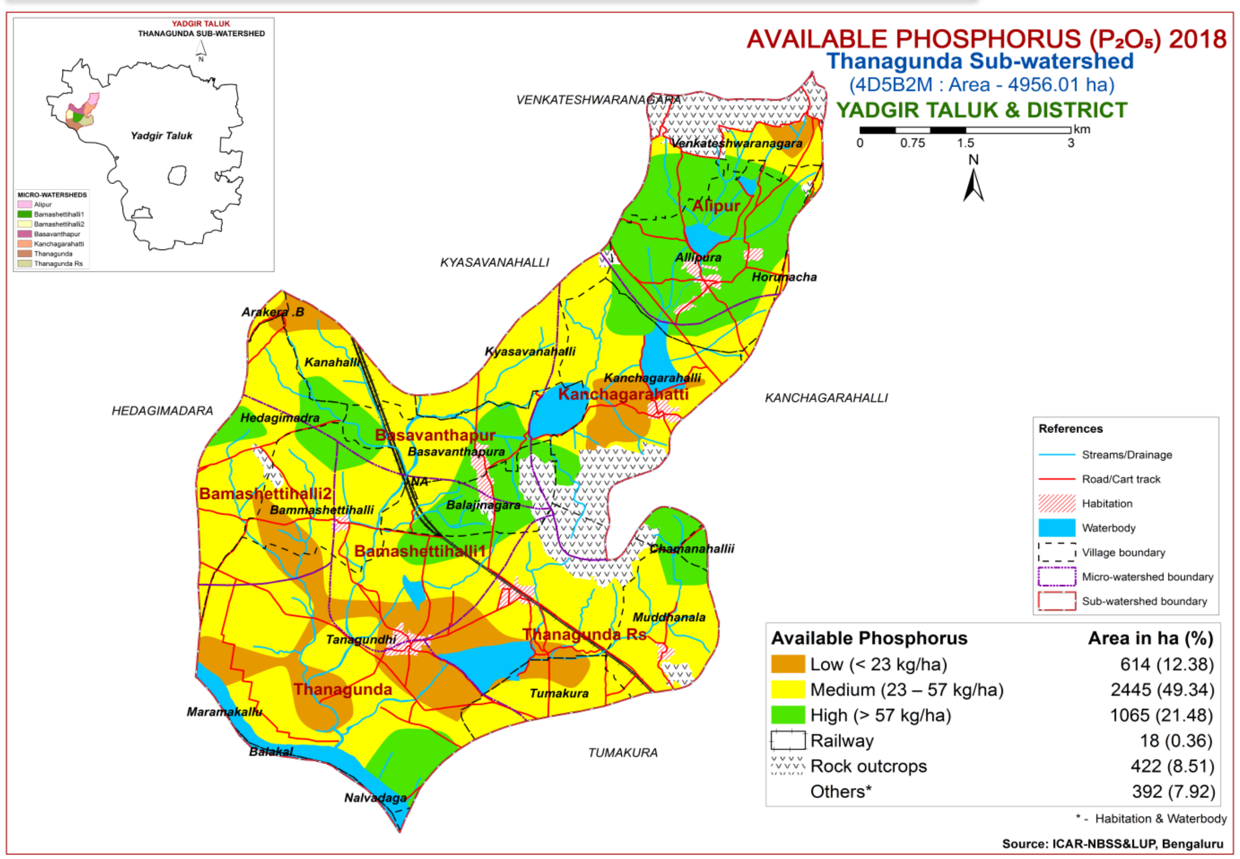
6.2 Electrical Conductivity (EC)



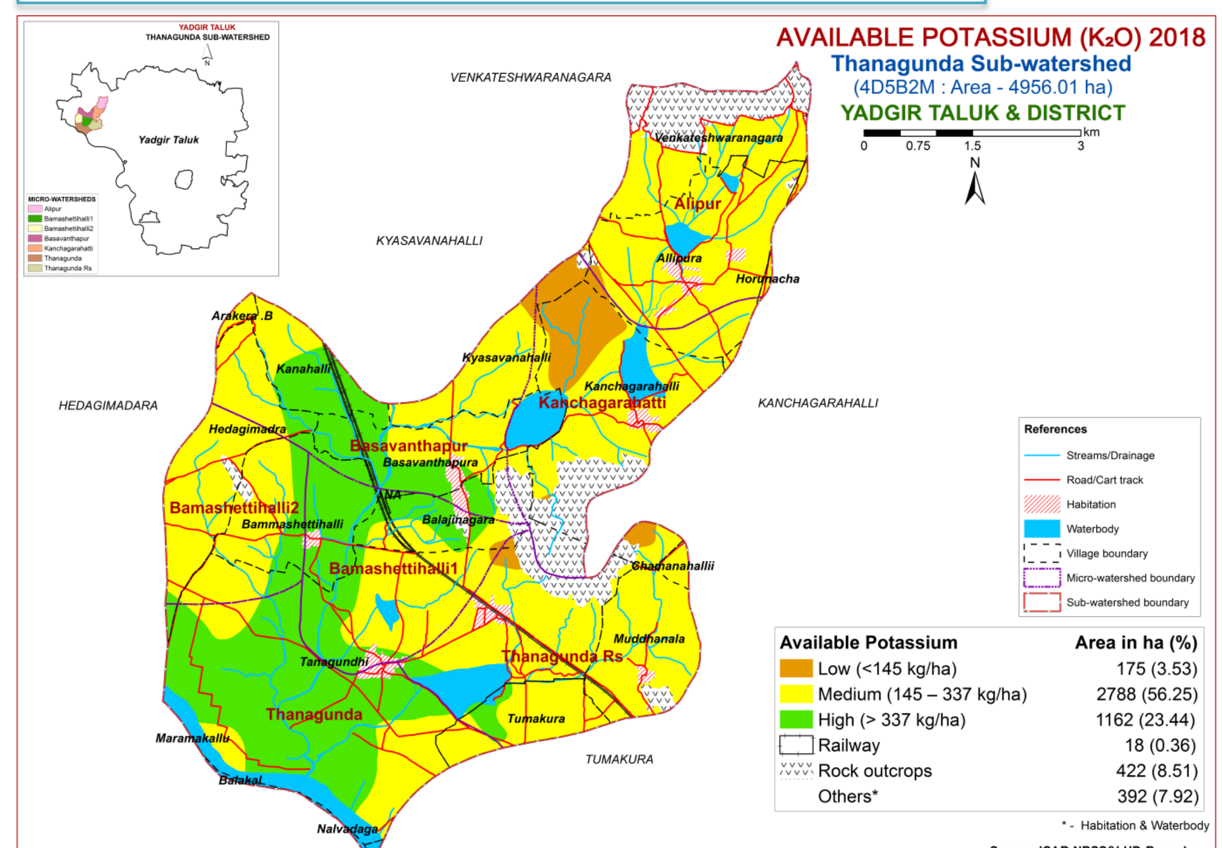
6.3. Organic Carbon



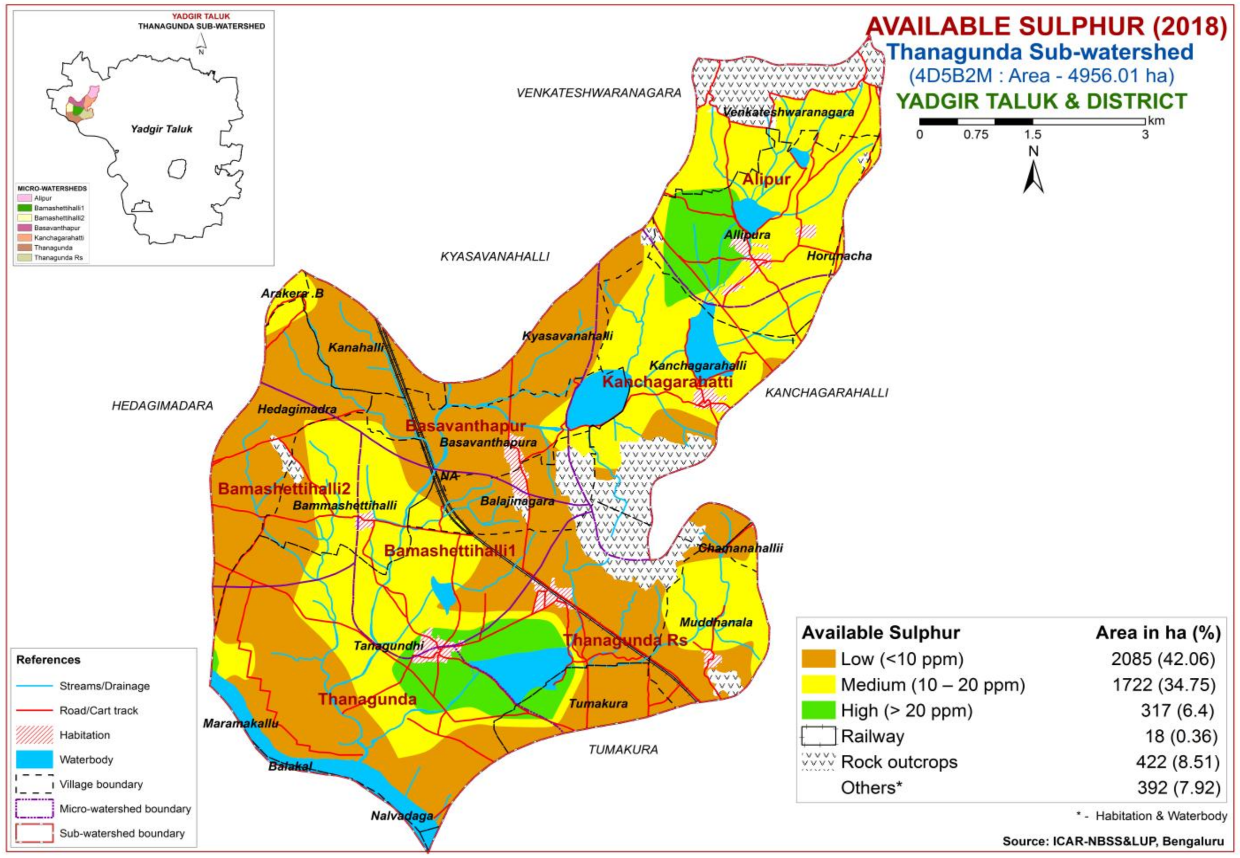
6.4. Available Phosphorus (P_2O_5)



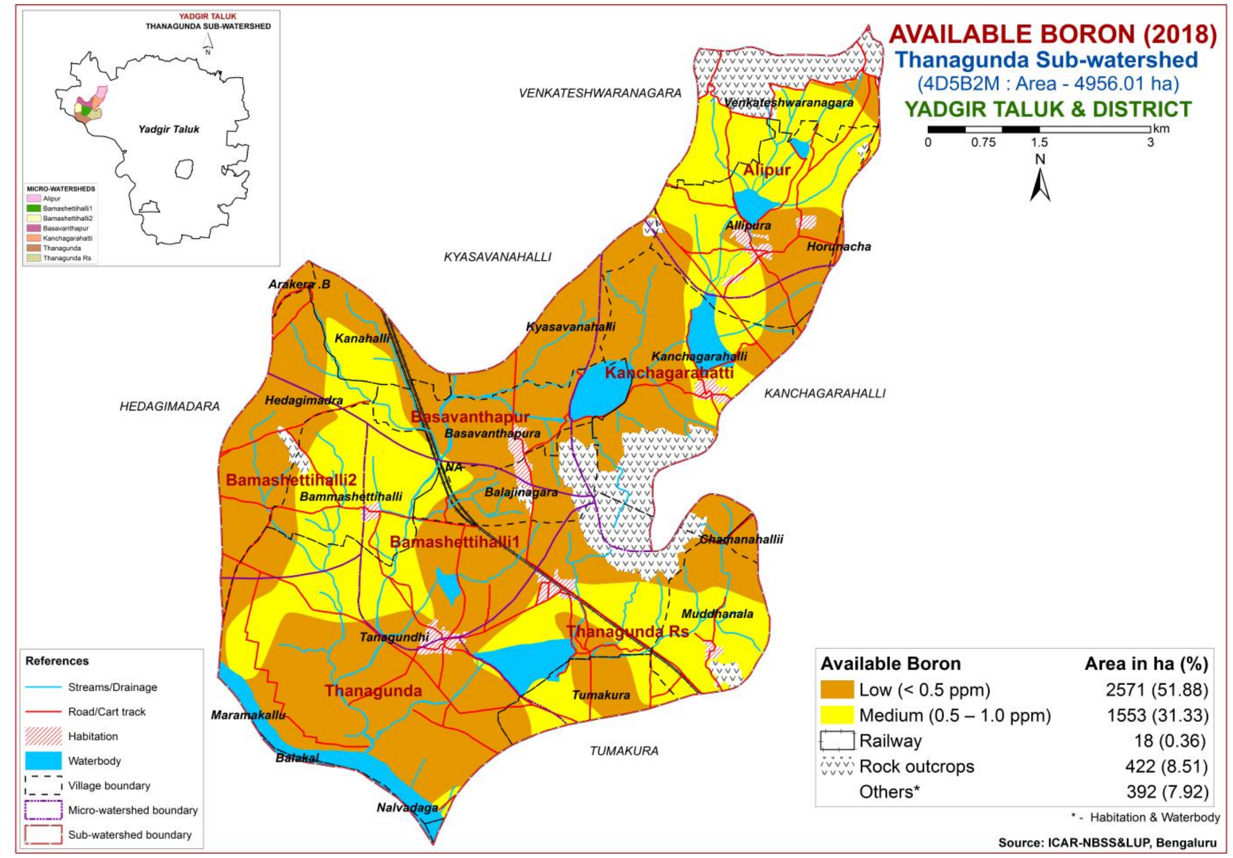
6.5. Available Potassium (K_2O)



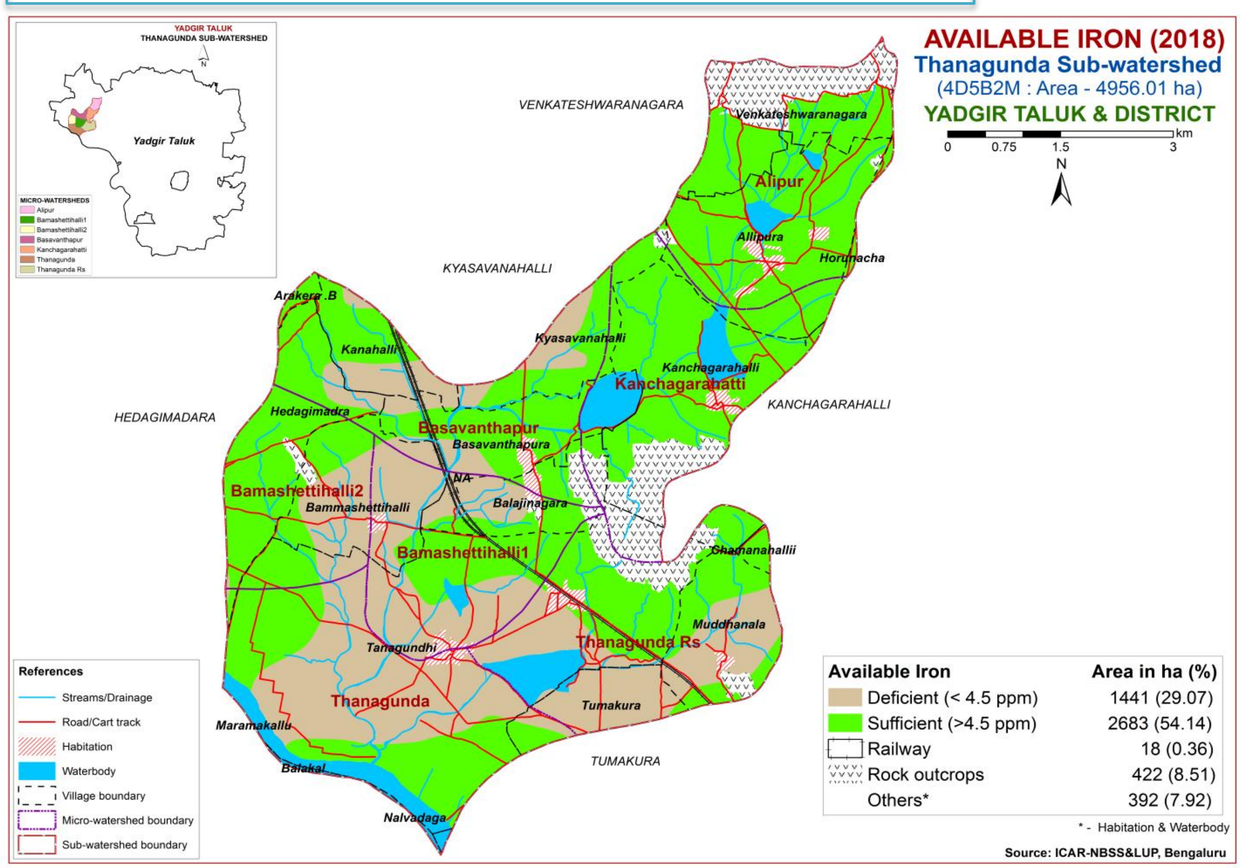
6.6. Available Sulphur



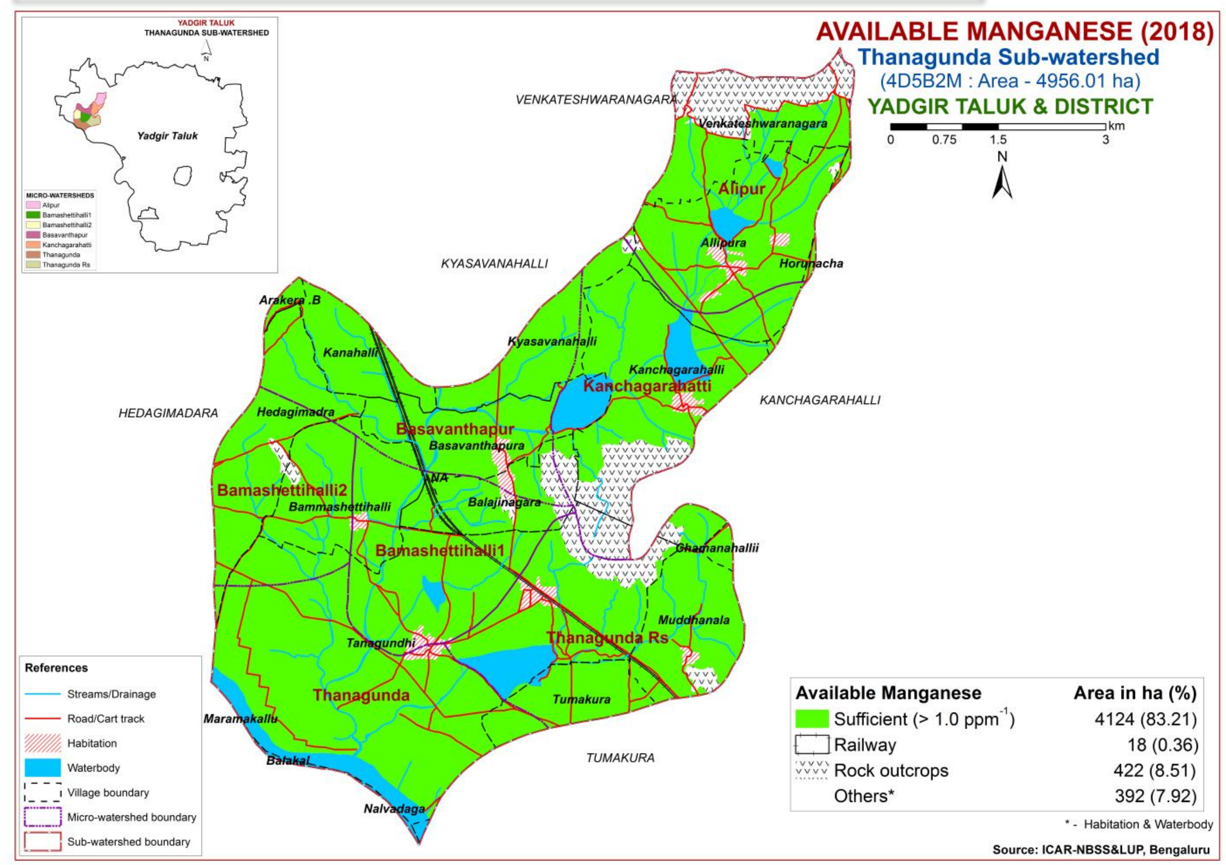
6.7. Available Boron



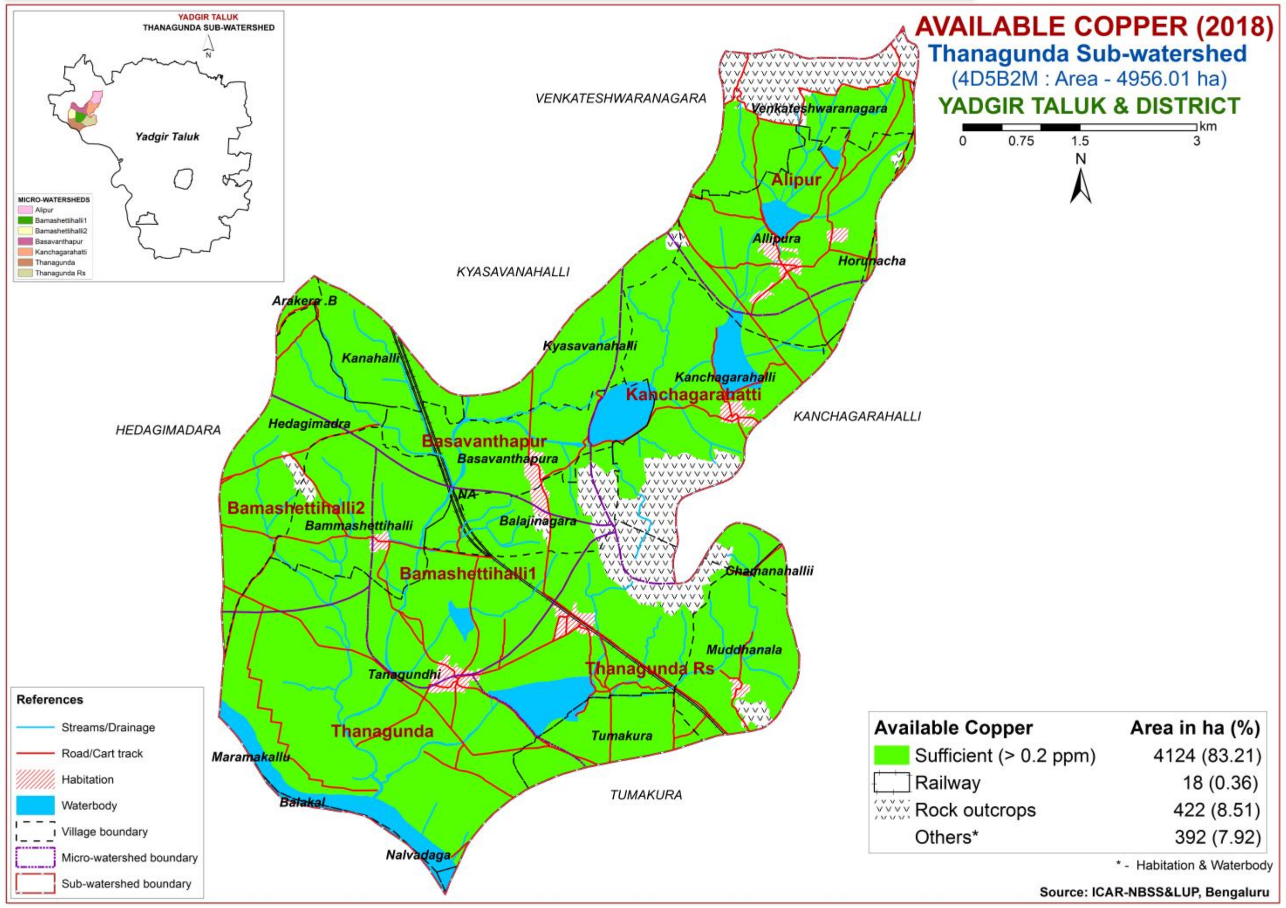
6.8. Available Iron



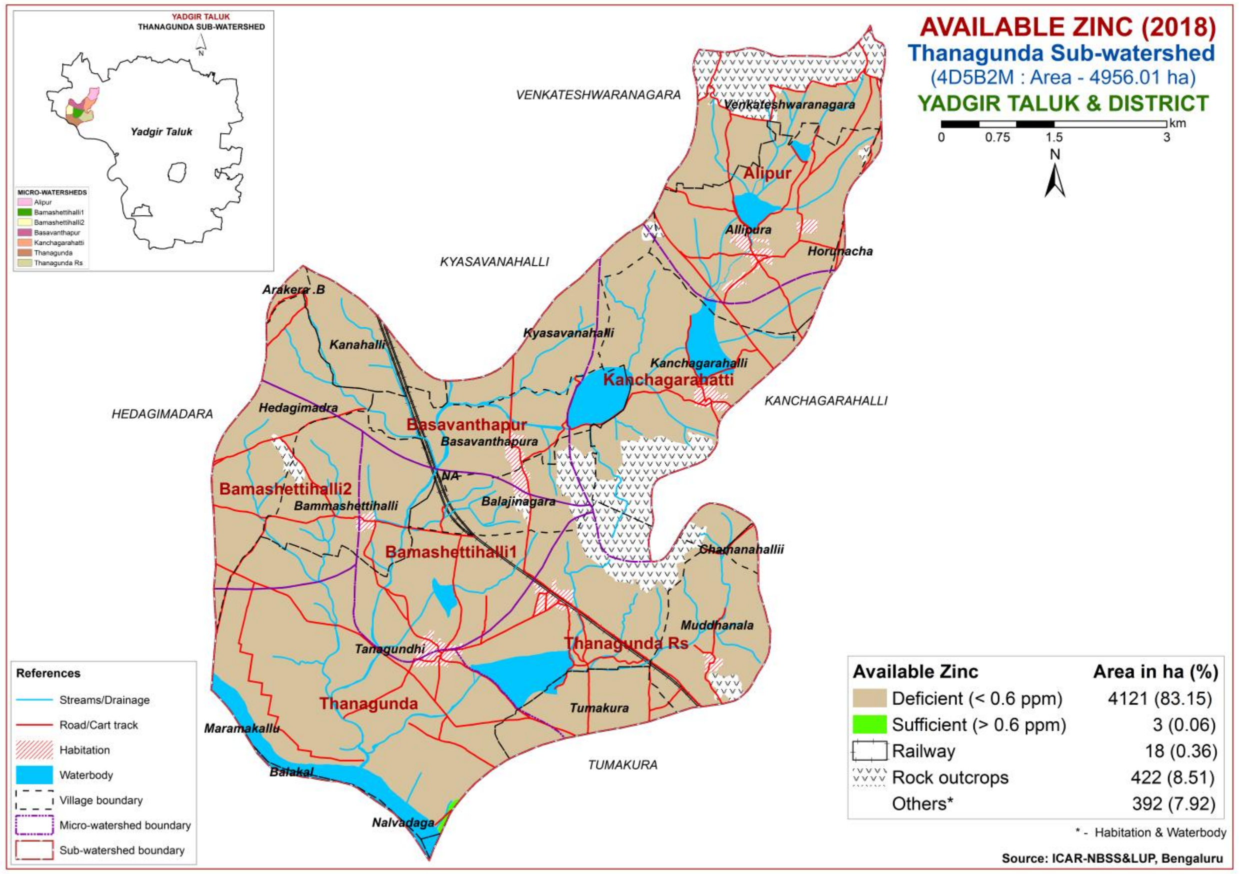
6.9. Available Manganese



6.10. Available Copper



6.11. Available Zinc



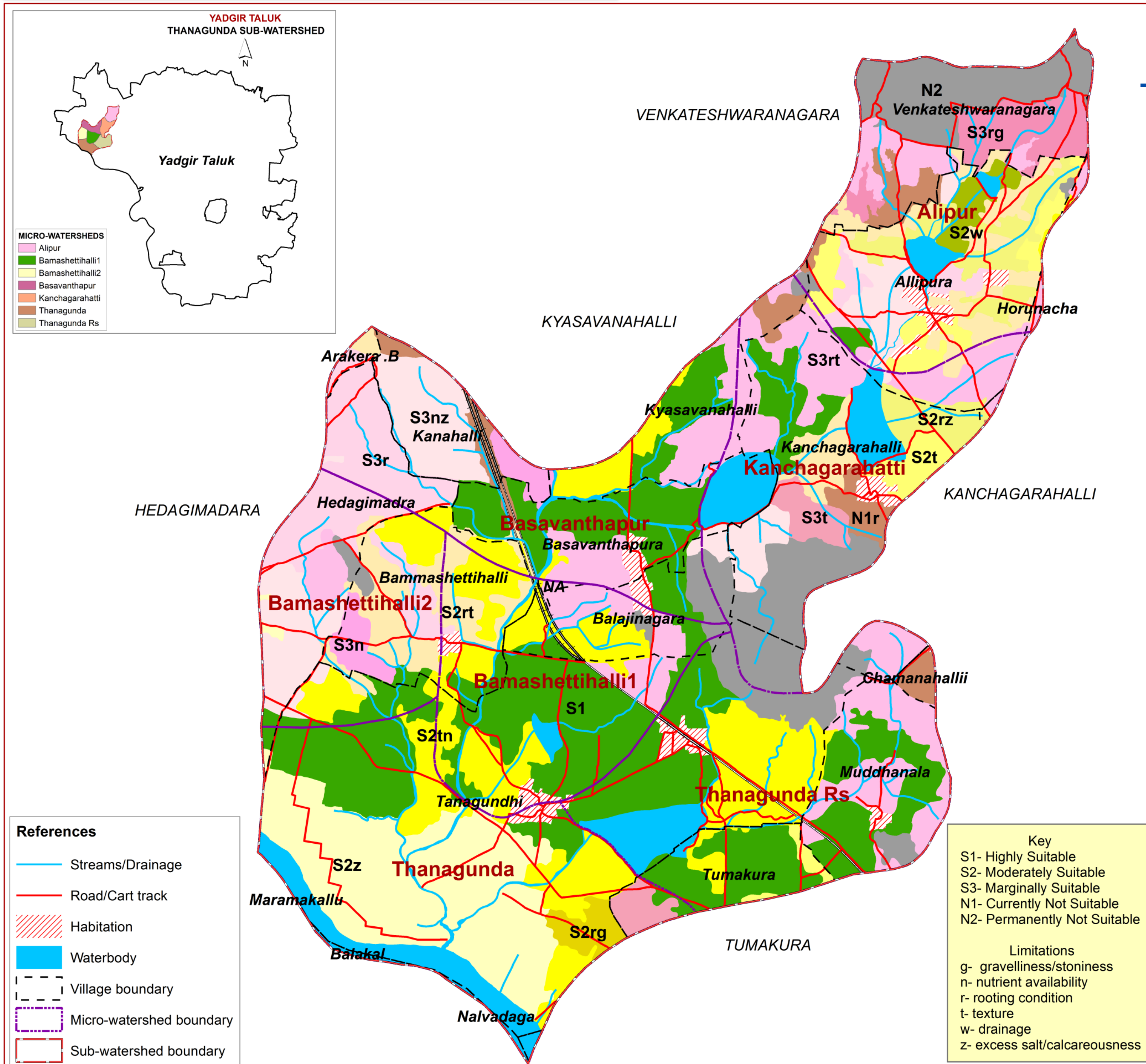
6.12. Correcting the Soil Nutrient Deficiencies

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.

7.1. Land Suitability for Sorghum

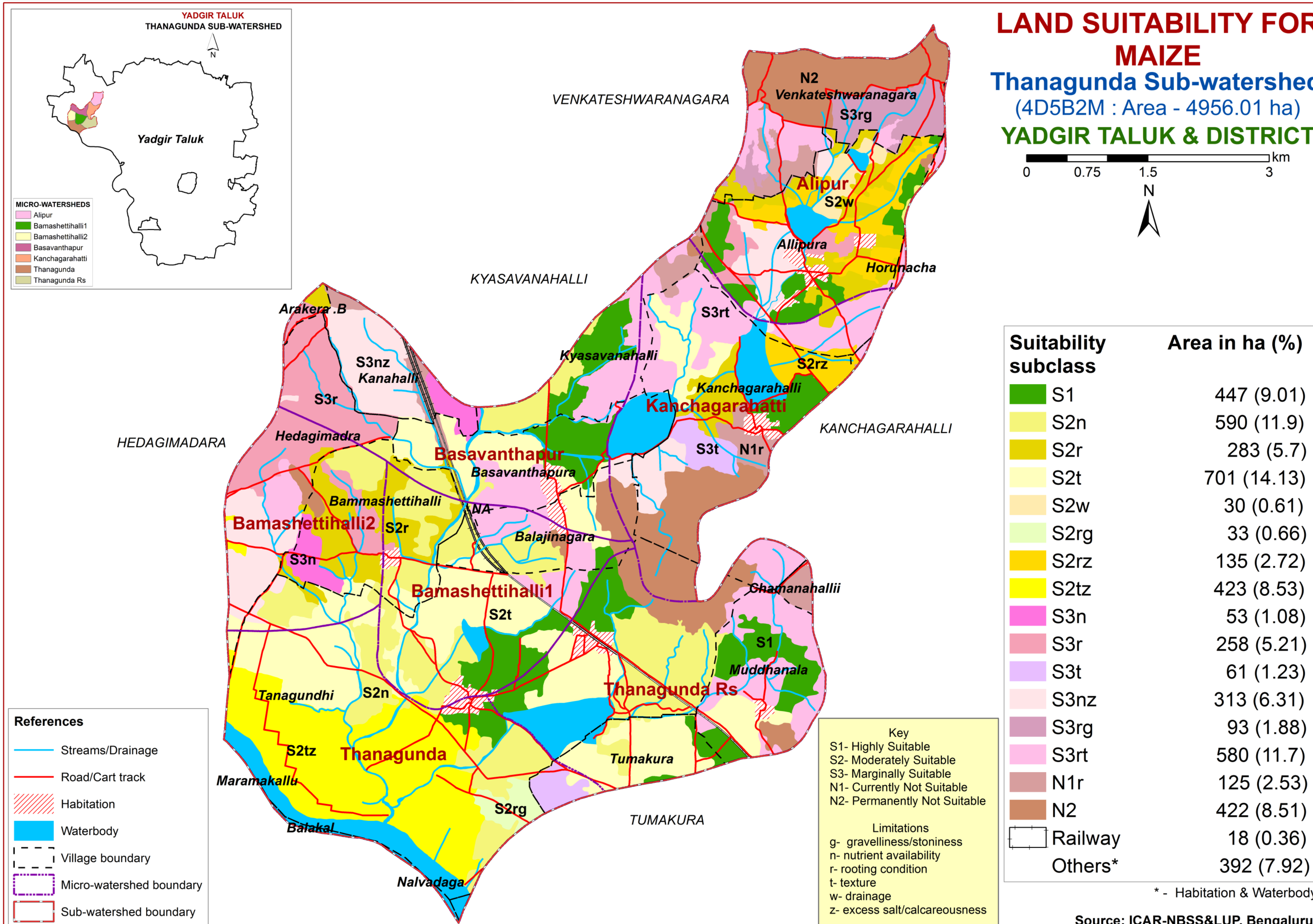


Suitability subclass	Area in ha (%)
S1	1040 (20.98)
S2t	107 (2.17)
S2w	30 (0.61)
S2z	423 (8.53)
S2rg	33 (0.66)
S2rt	283 (5.7)
S2rz	135 (2.72)
S2tn	590 (11.9)
S3n	53 (1.08)
S3r	258 (5.21)
S3t	61 (1.23)
S3nz	313 (6.31)
S3rg	93 (1.88)
S3rt	580 (11.7)
N1r	125 (2.53)
N2	422 (8.51)
Railway	18 (0.36)
Others*	392 (7.92)

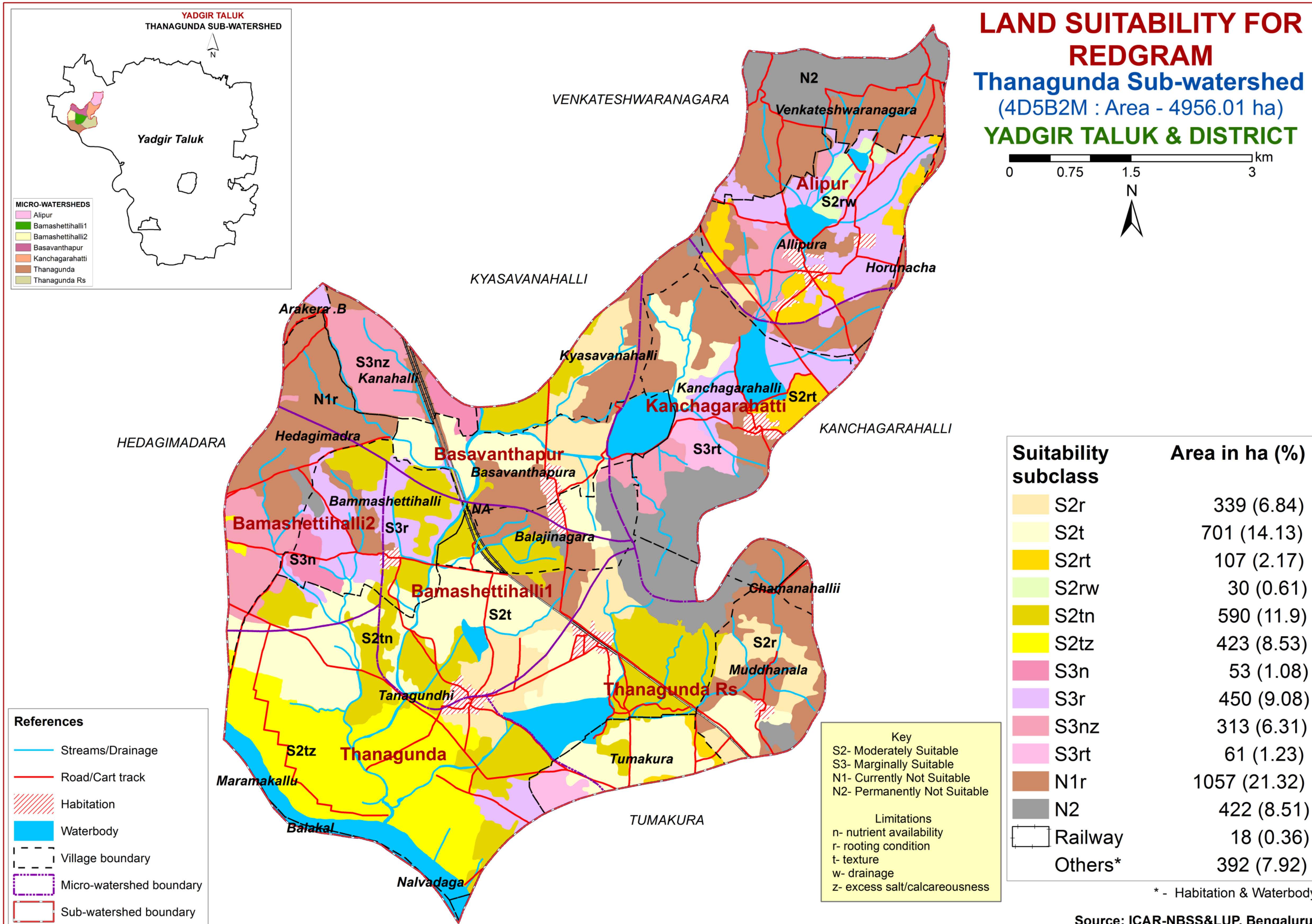
* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

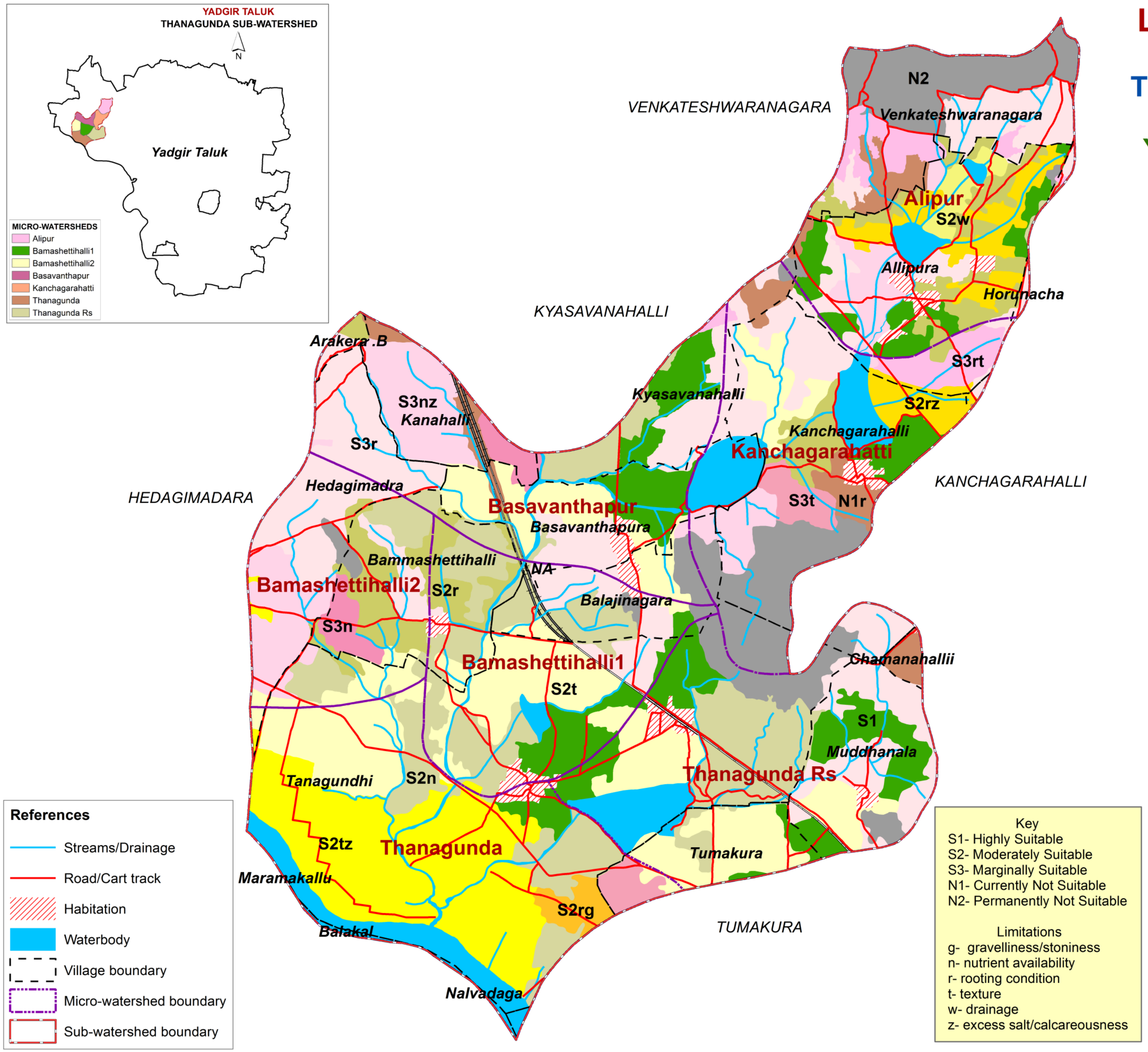
7.2. Land Suitability for Maize



7.3. Land Suitability for Redgram



7.4. Land Suitability for Bajra



Suitability subclass	Area in ha (%)
S1	447 (9.01)
S2n	590 (11.9)
S2r	283 (5.7)
S2t	701 (14.13)
S2w	30 (0.61)
S2rg	33 (0.66)
S2rz	135 (2.72)
S2tz	423 (8.53)
S3n	53 (1.08)
S3r	823 (16.61)
S3t	61 (1.23)
S3nz	313 (6.31)
S3rt	108 (2.18)
N1r	125 (2.53)
N2	422 (8.51)
Railway	18 (0.36)
Others*	392 (7.92)

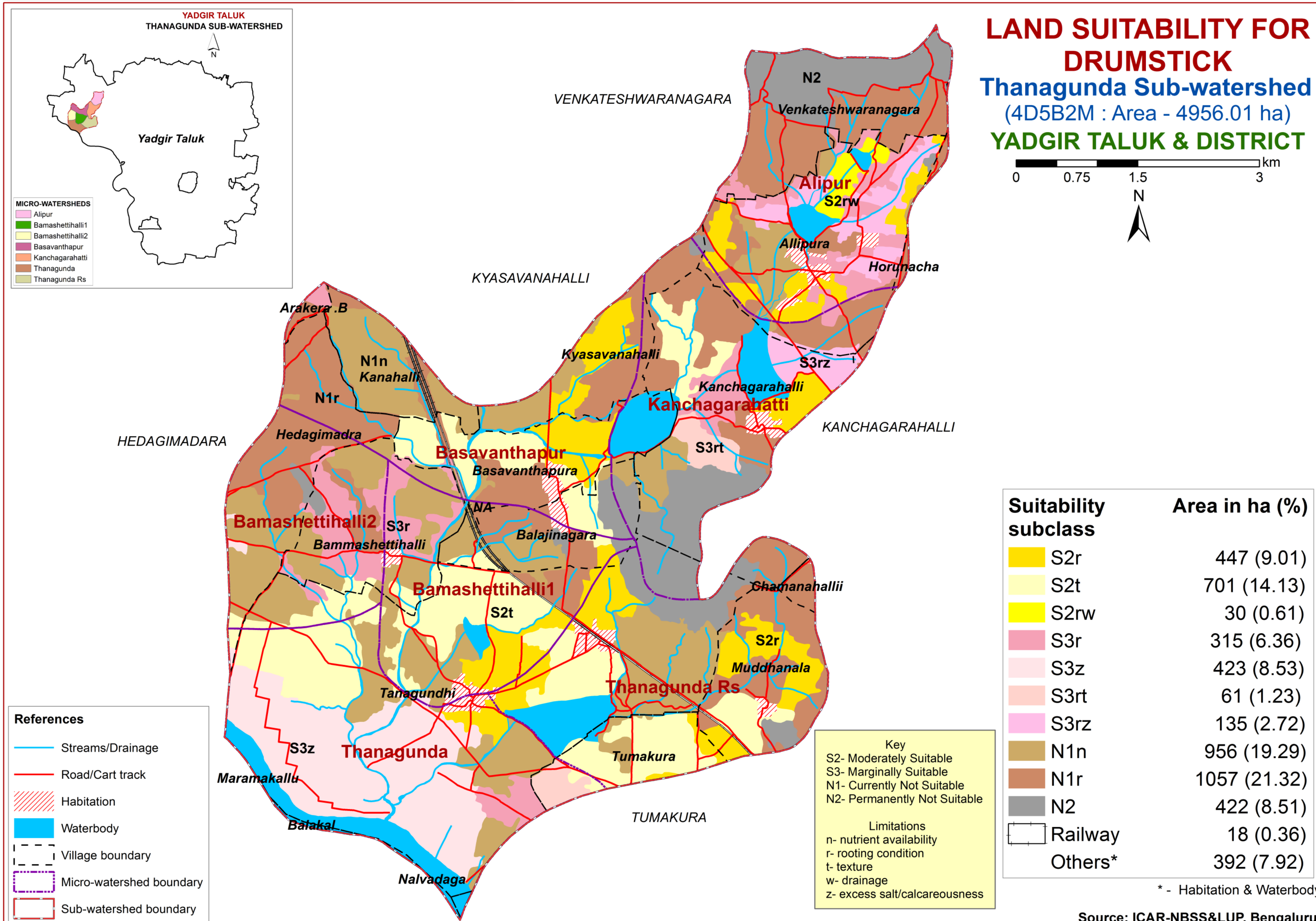
* - Habitation & Waterbody

Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable
N2- Permanently Not Suitable

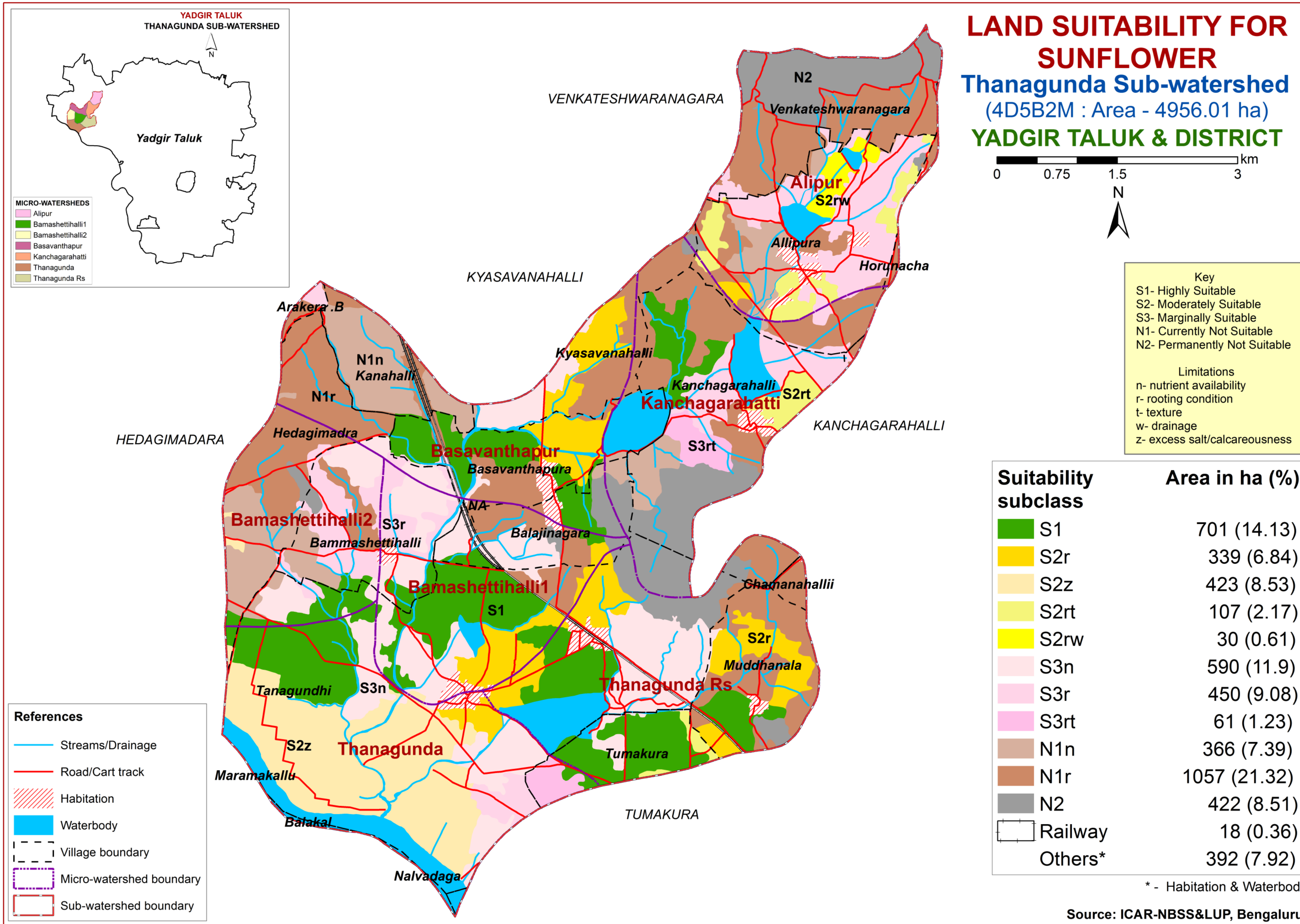
Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
w- drainage
z- excess salt/calcareousness

Source: ICAR-NBSS&LUP, Bengaluru

7.5. Land Suitability for Drumstick



7.6. Land Suitability for Sunflower

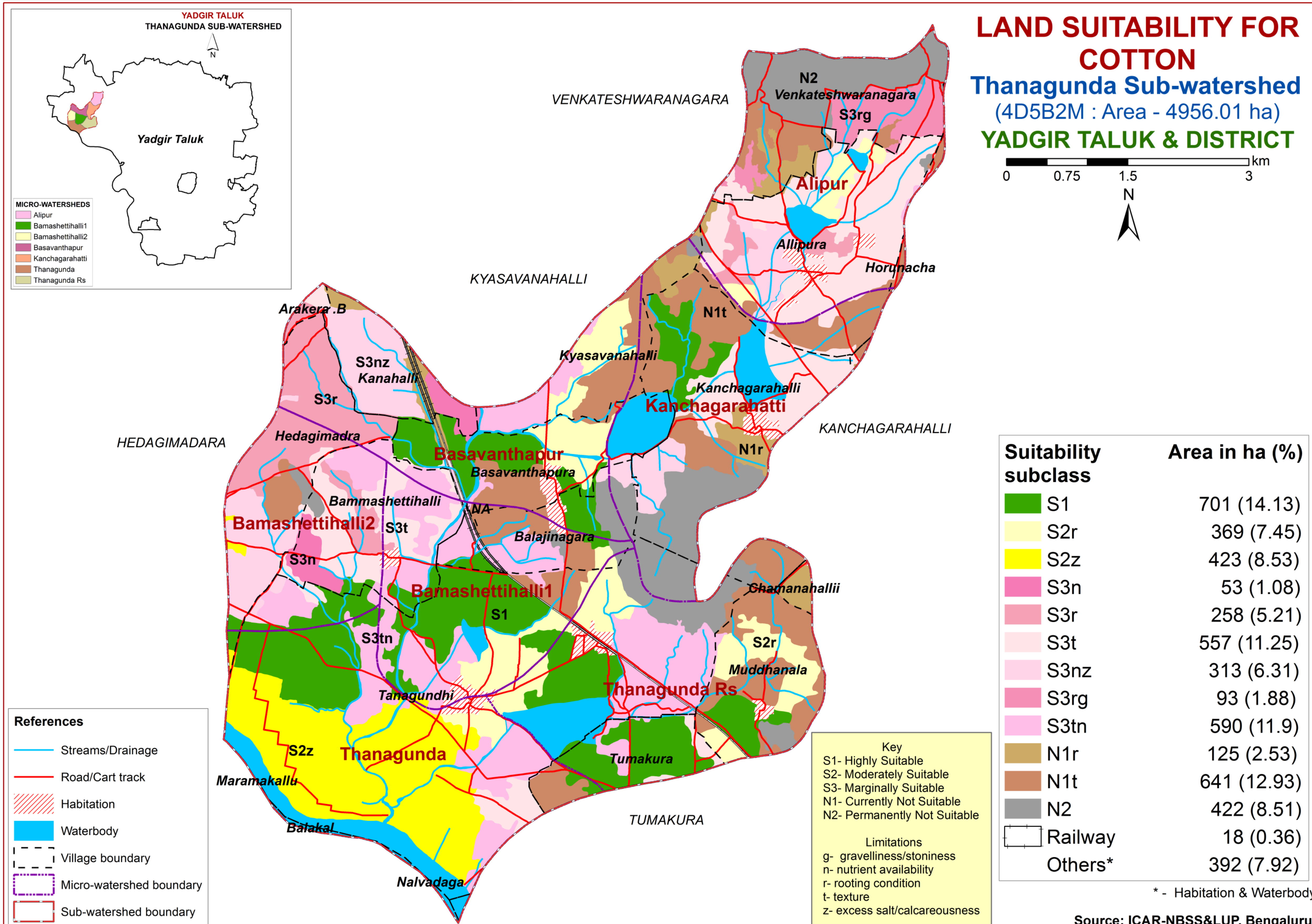


Suitability subclass	Area in ha (%)
S1	701 (14.13)
S2r	339 (6.84)
S2z	423 (8.53)
S2rt	107 (2.17)
S2rw	30 (0.61)
S3n	590 (11.9)
S3r	450 (9.08)
S3rt	61 (1.23)
N1n	366 (7.39)
N1r	1057 (21.32)
N2	422 (8.51)
Railway	18 (0.36)
Others*	392 (7.92)

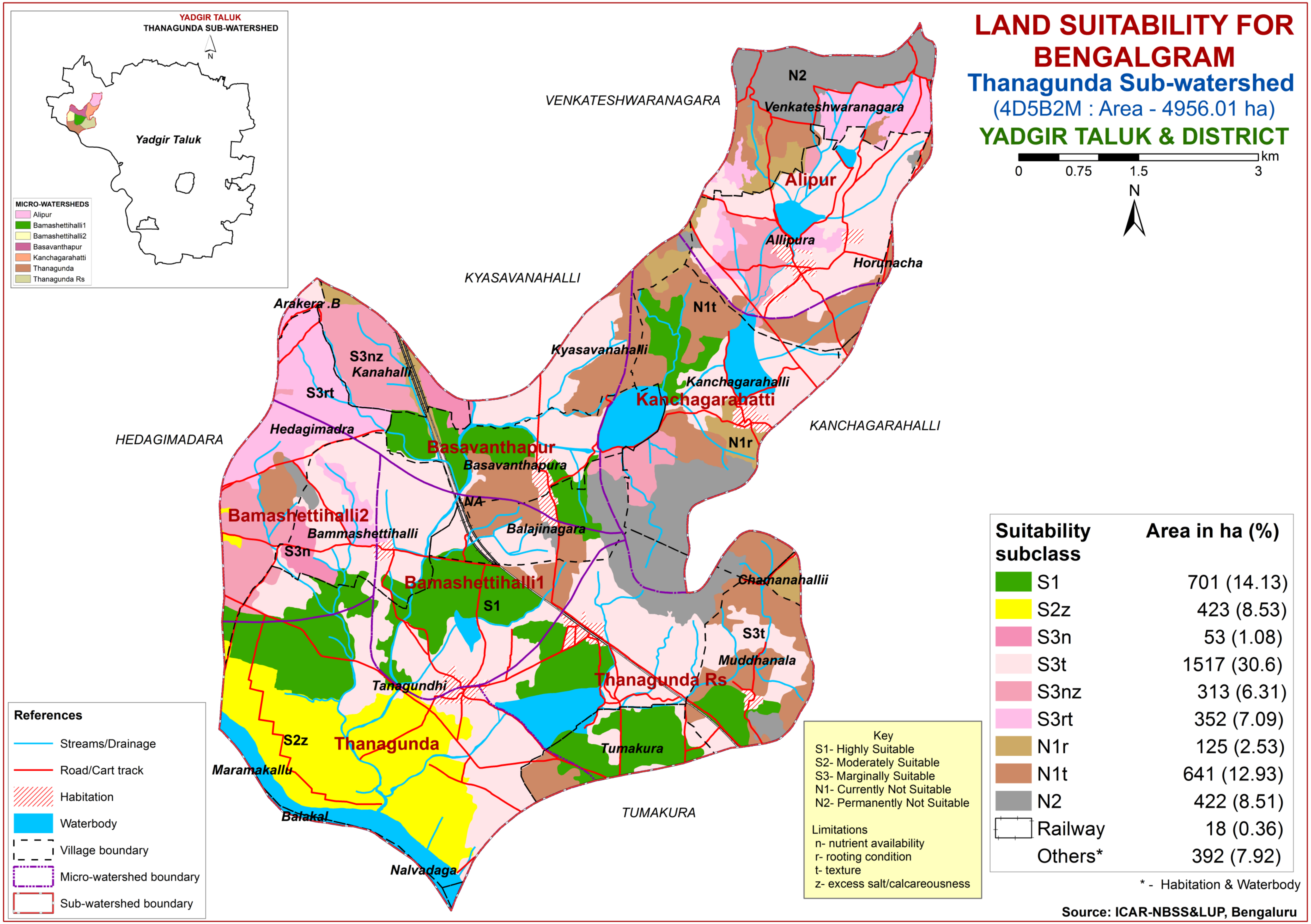
* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

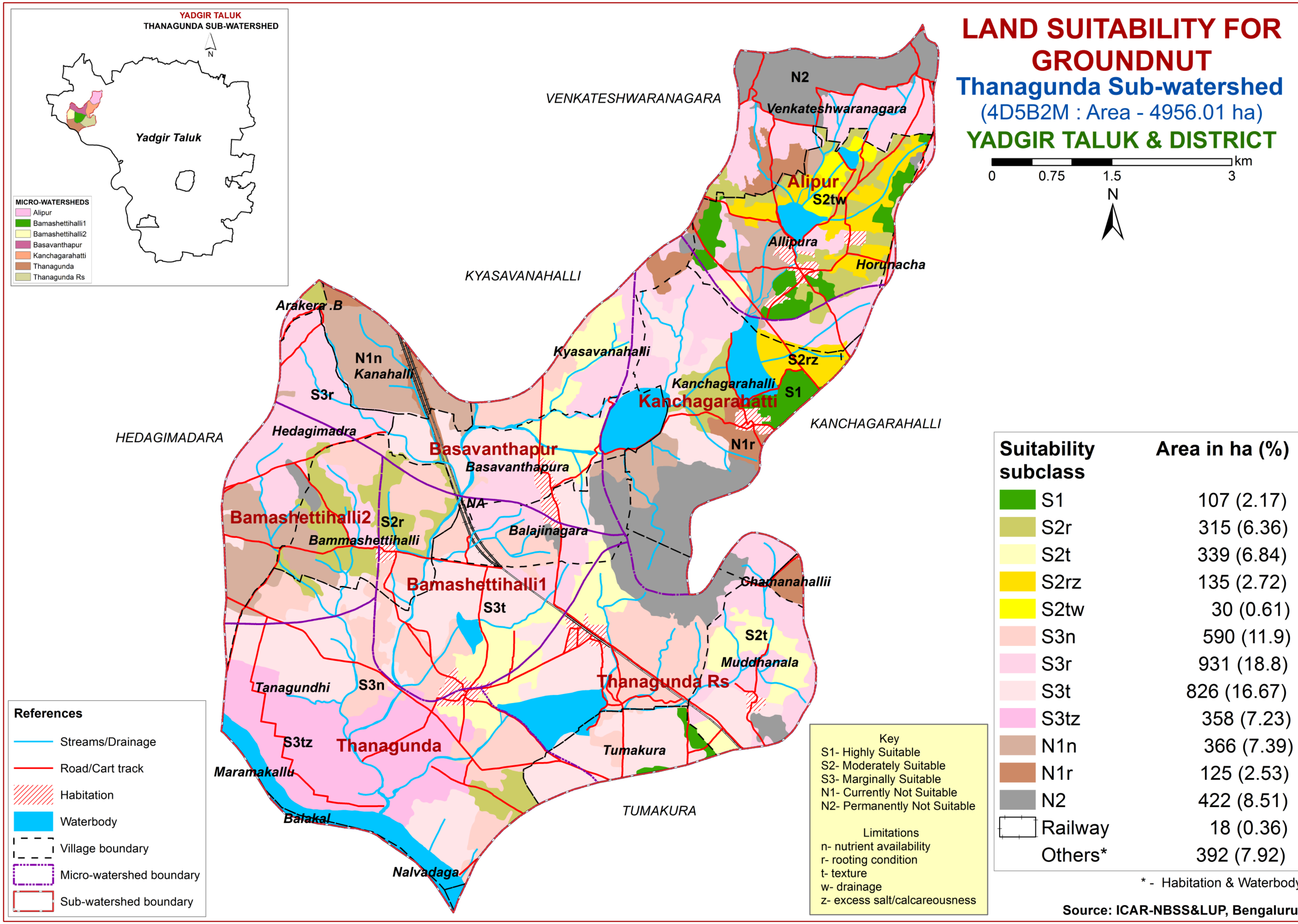
7.7. Land Suitability for Cotton



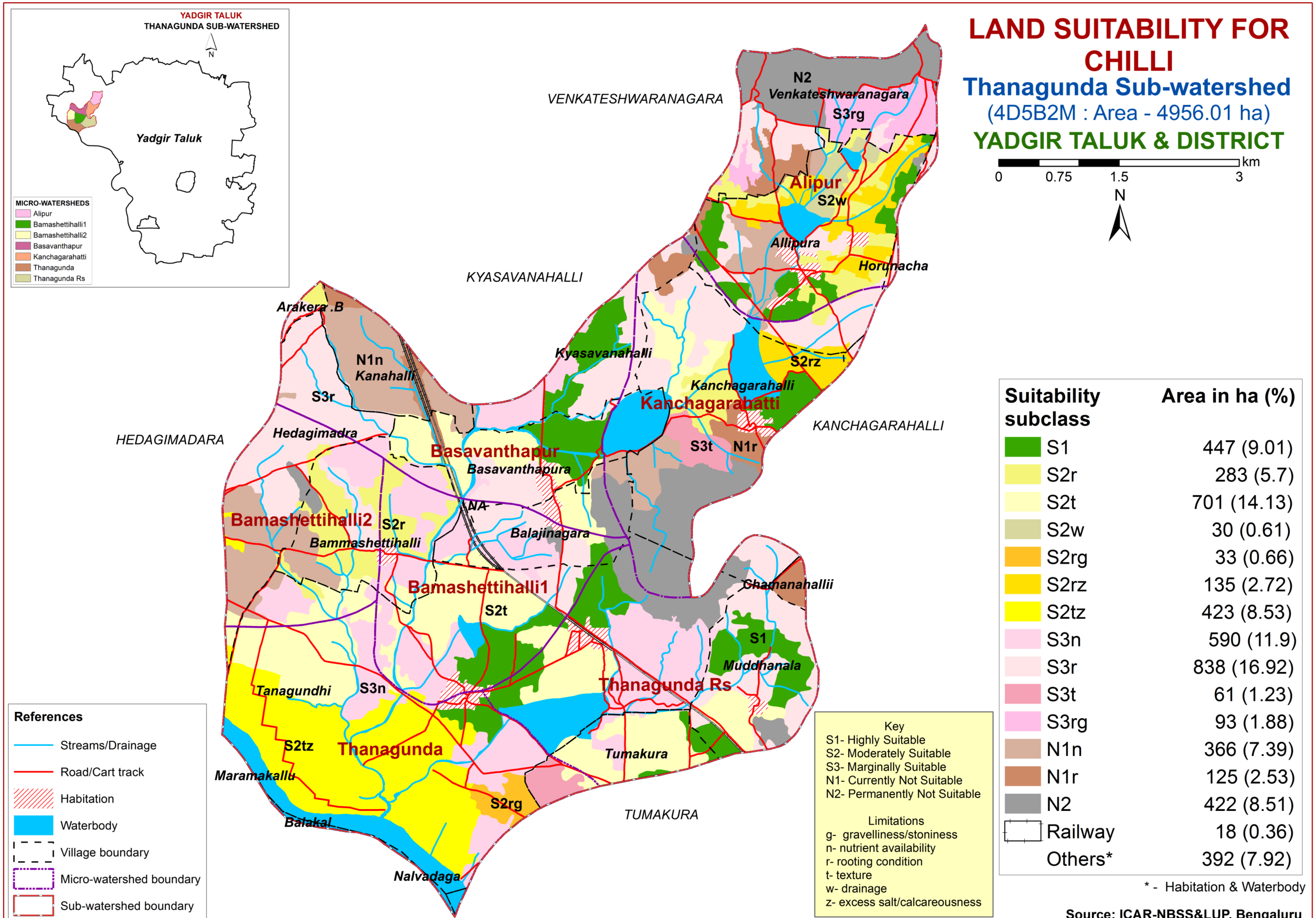
7.8. Land Suitability for Bengalgram



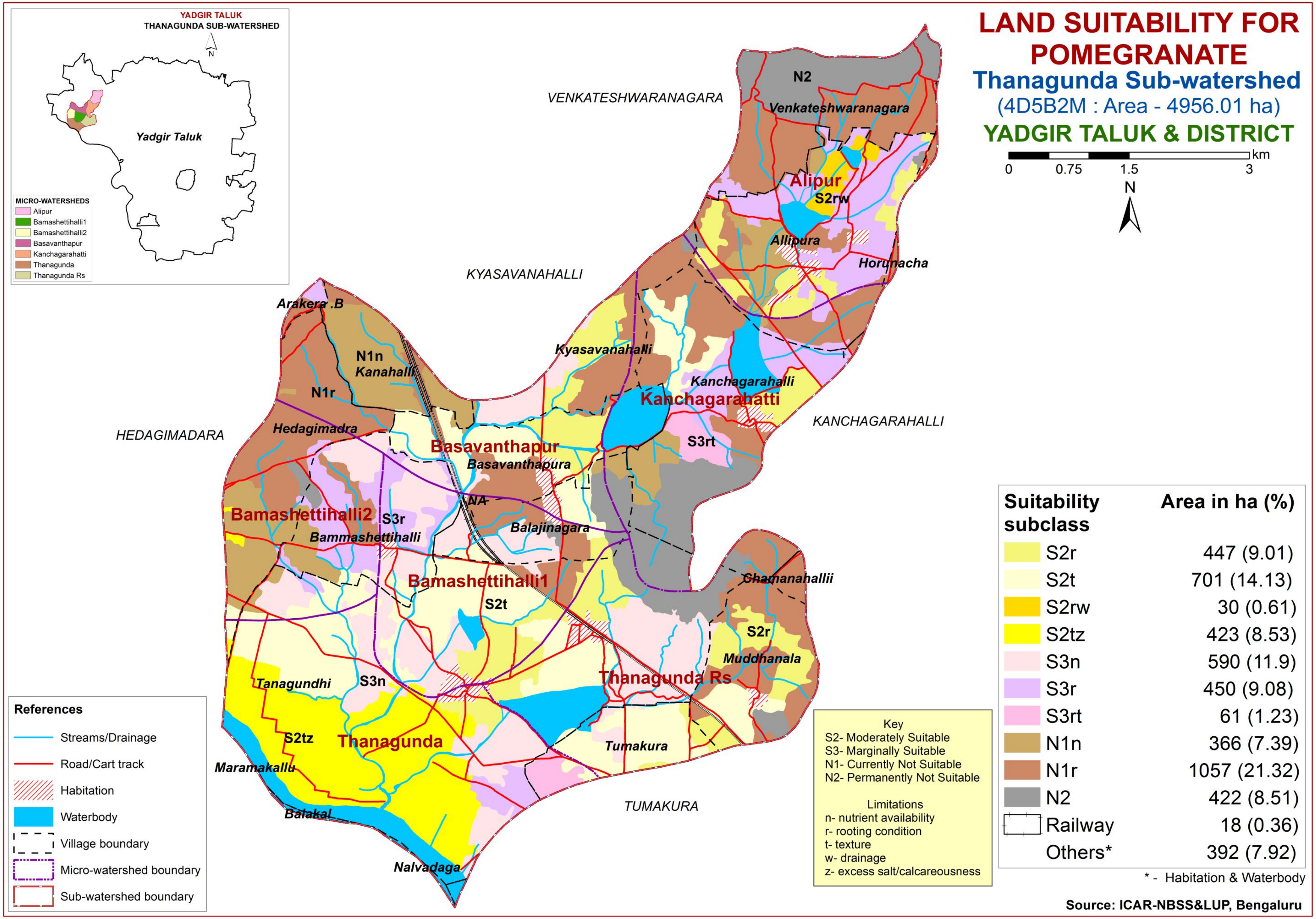
7.9. Land Suitability for Groundnut



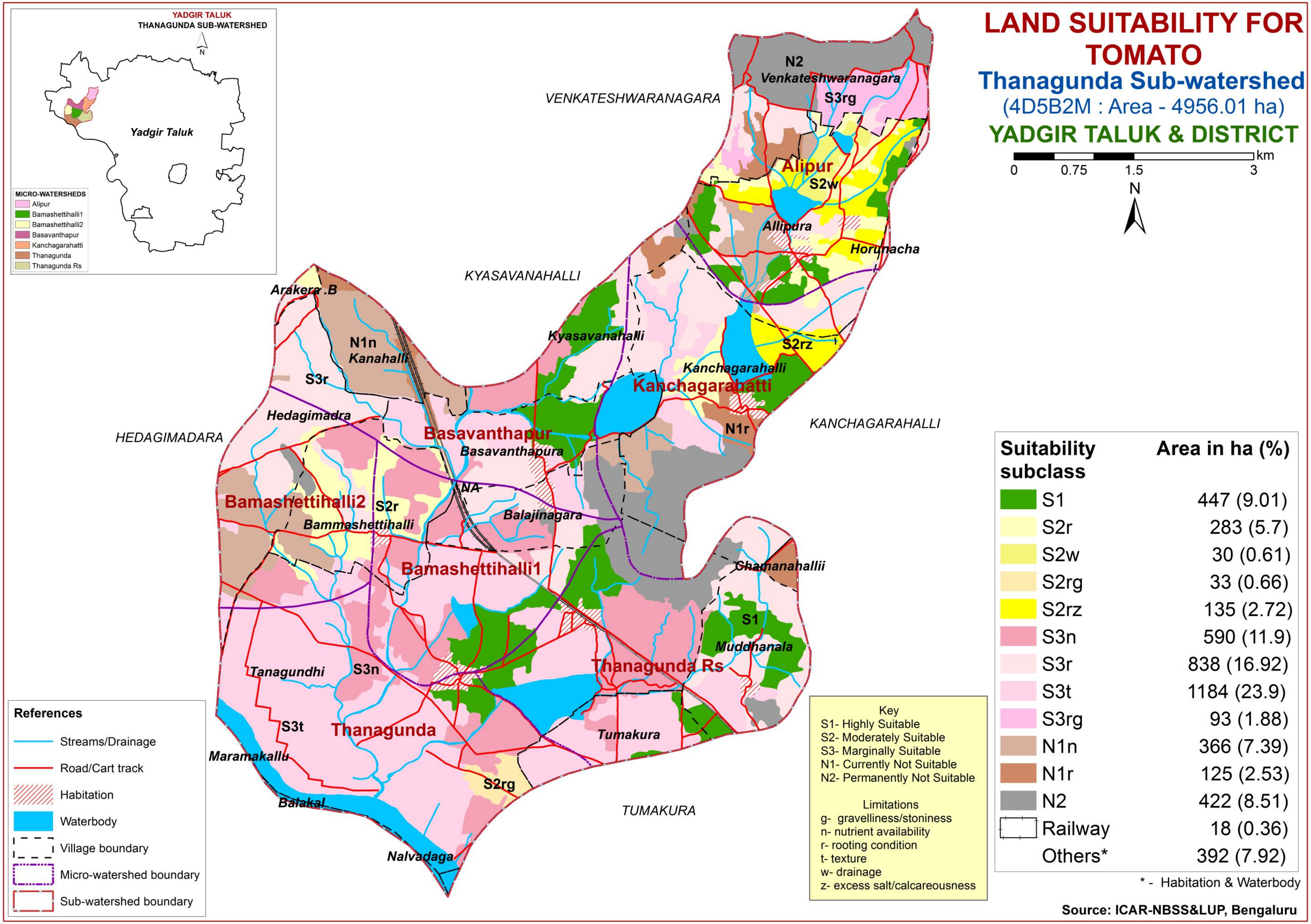
7.10. Land Suitability for Chilli



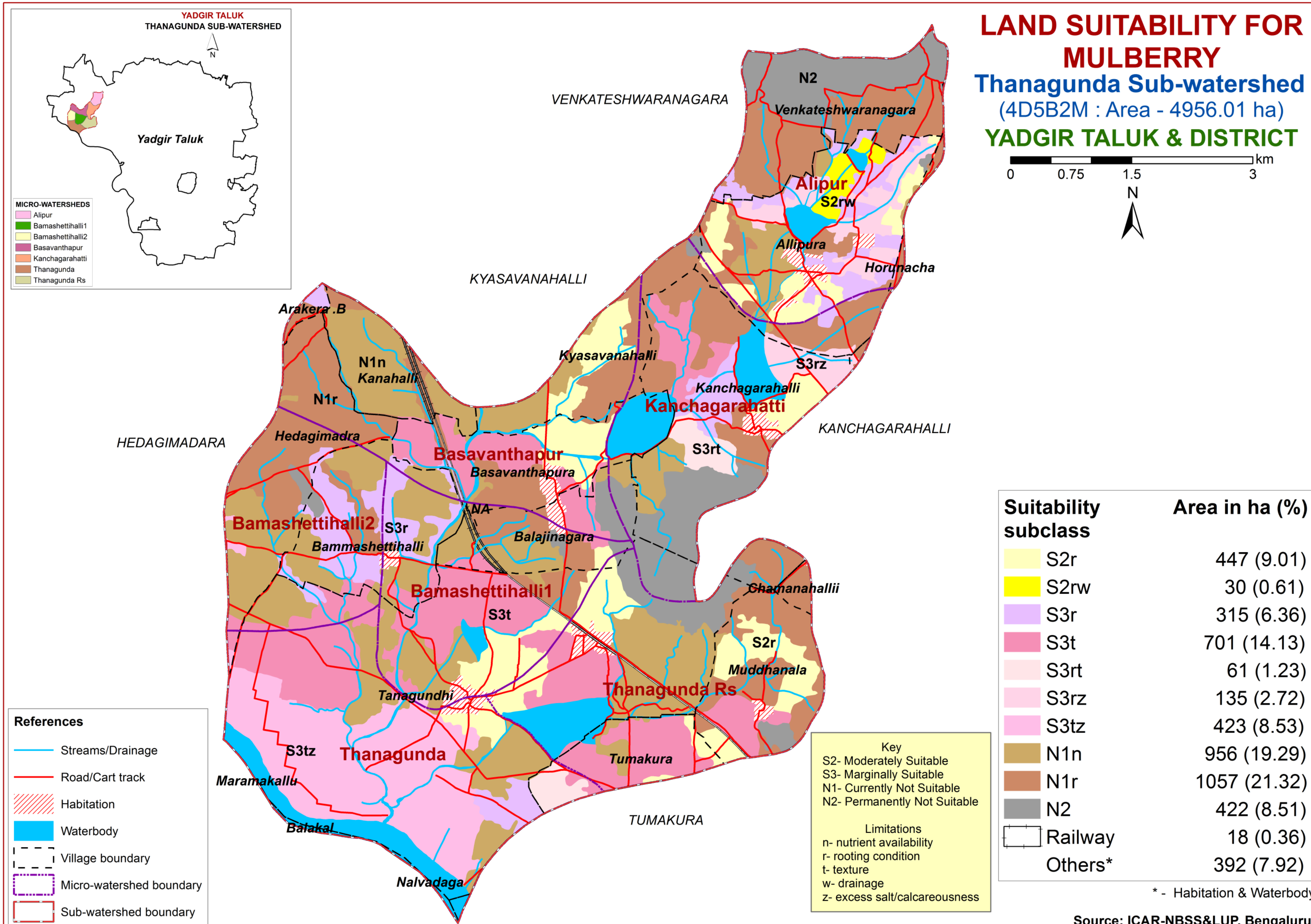
7.11. Land Suitability for Pomegranate



7.12. Land Suitability for Tomato

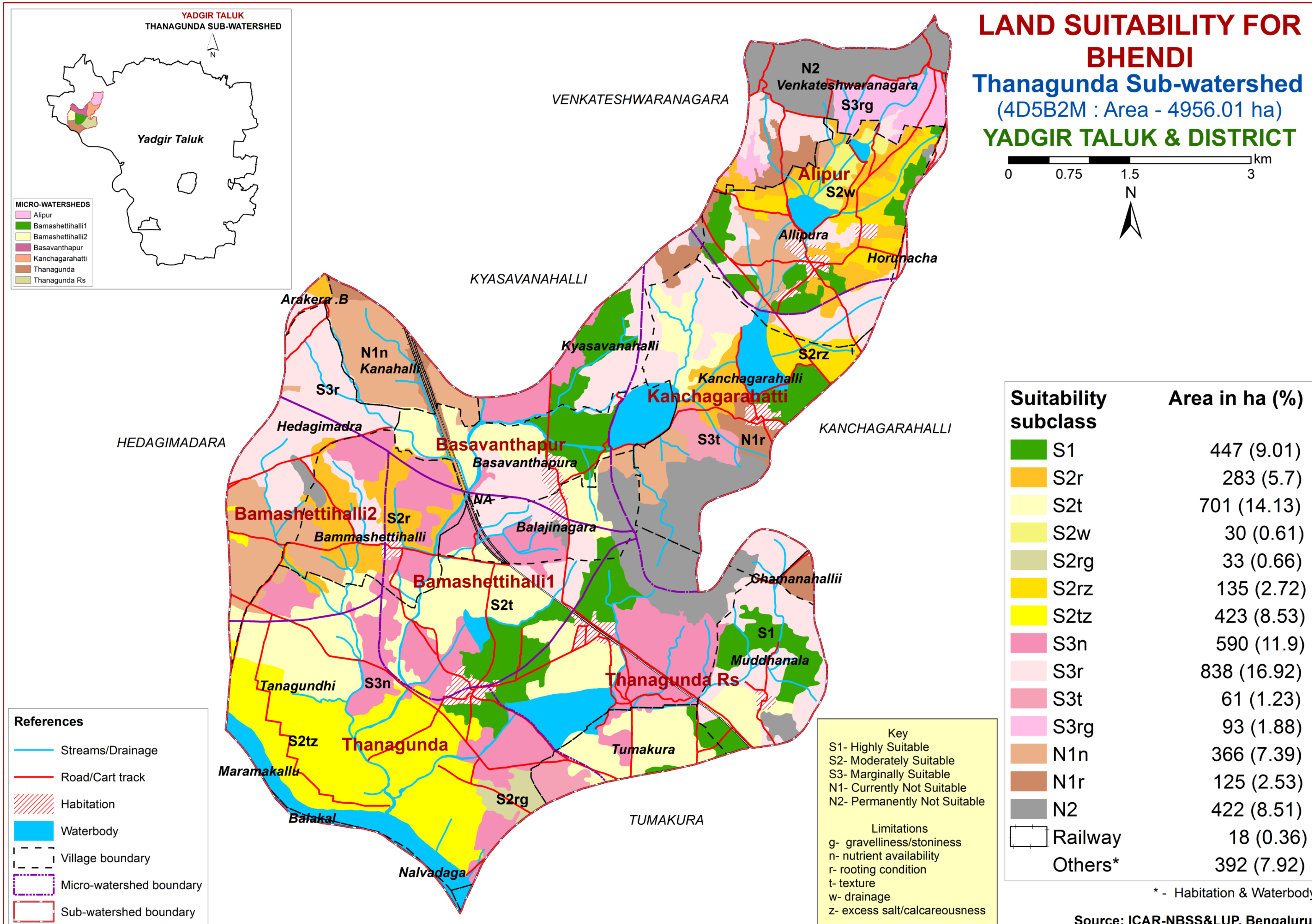


7.13. Land Suitability for Mulberry

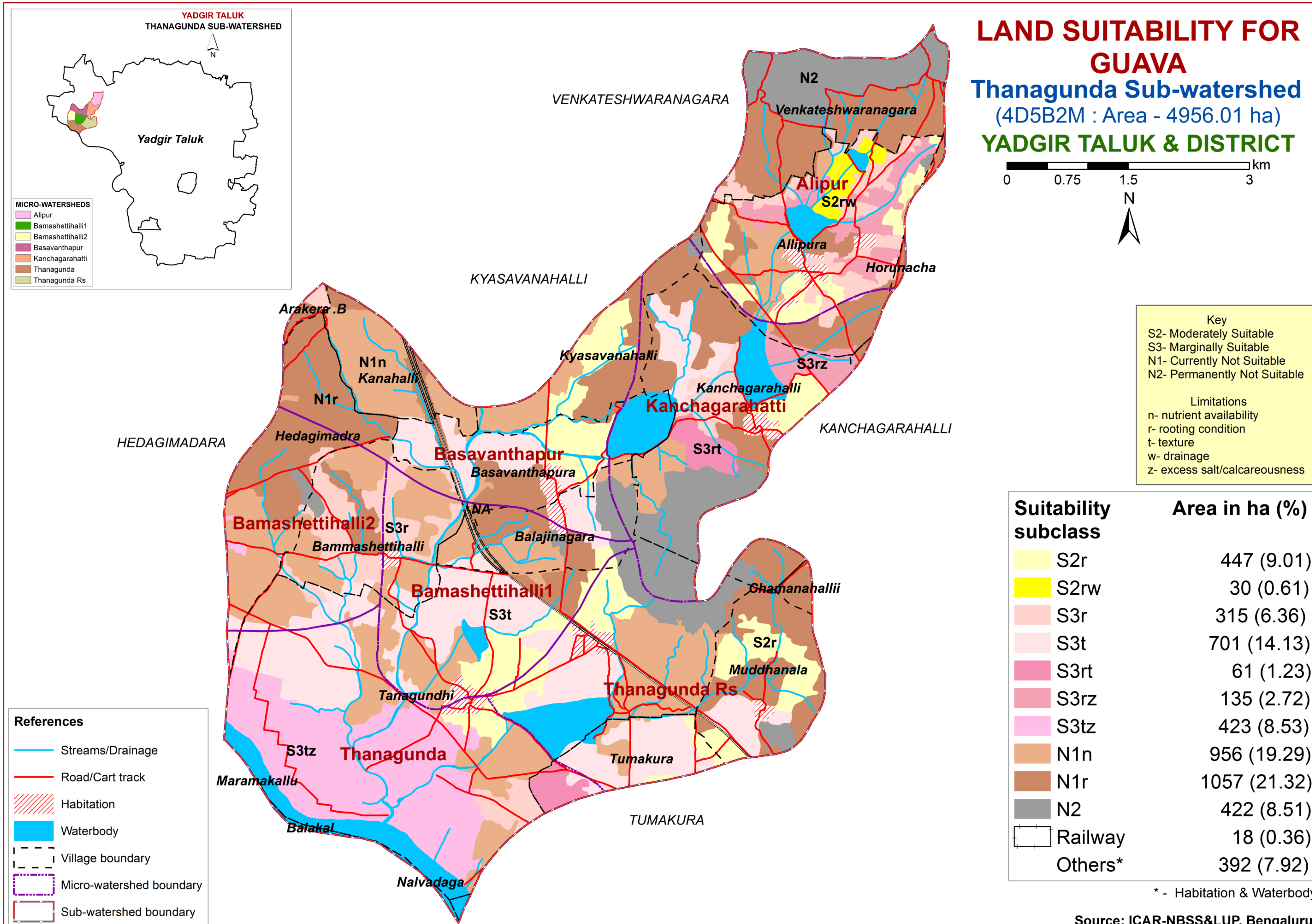


NOTE: Mulberry suitability evaluation only for mulberry leaf, not for silkworm rearing

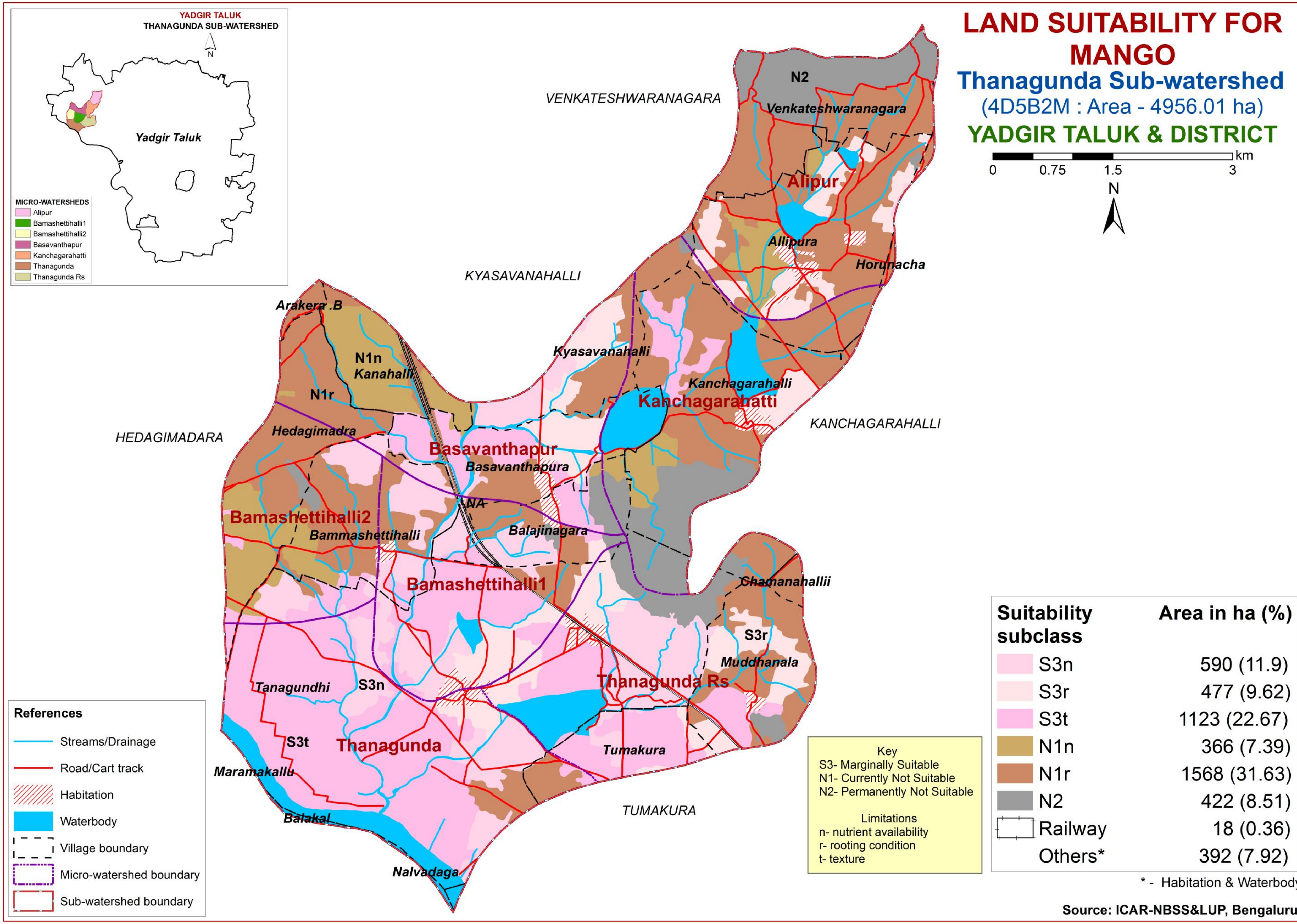
7.14. Land Suitability for Bhendi



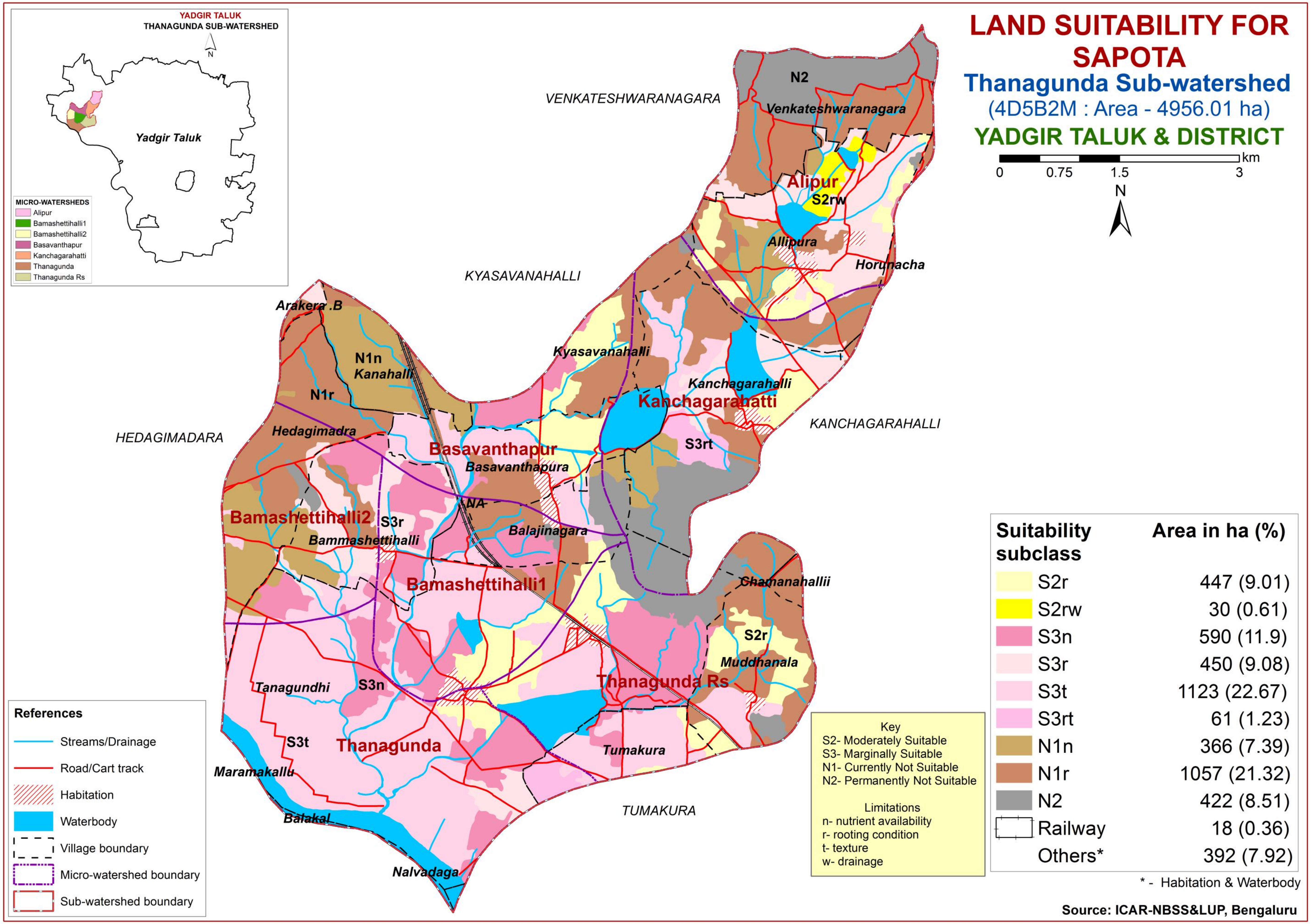
7.15. Land Suitability for Guava



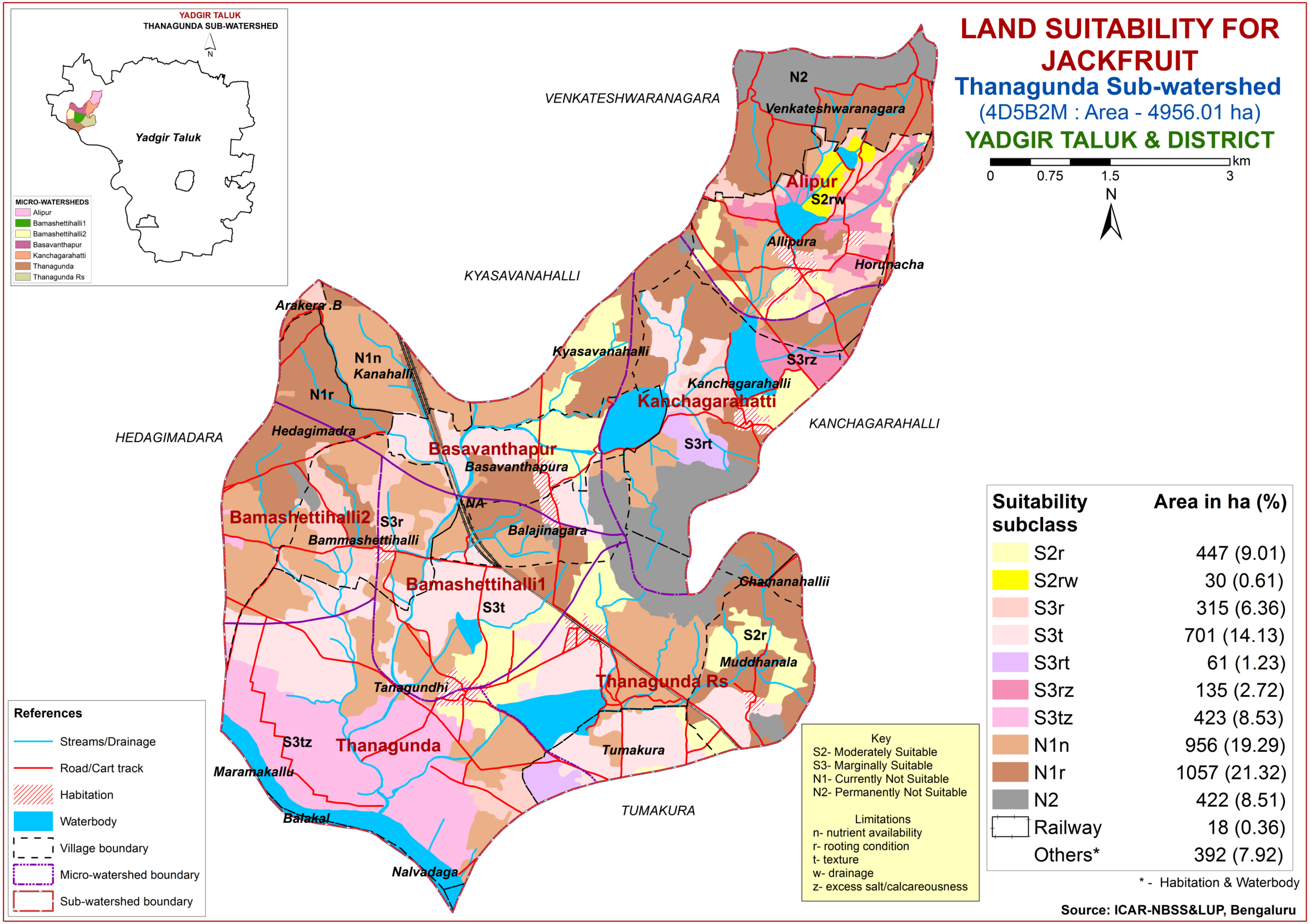
7.16. Land Suitability for Mango



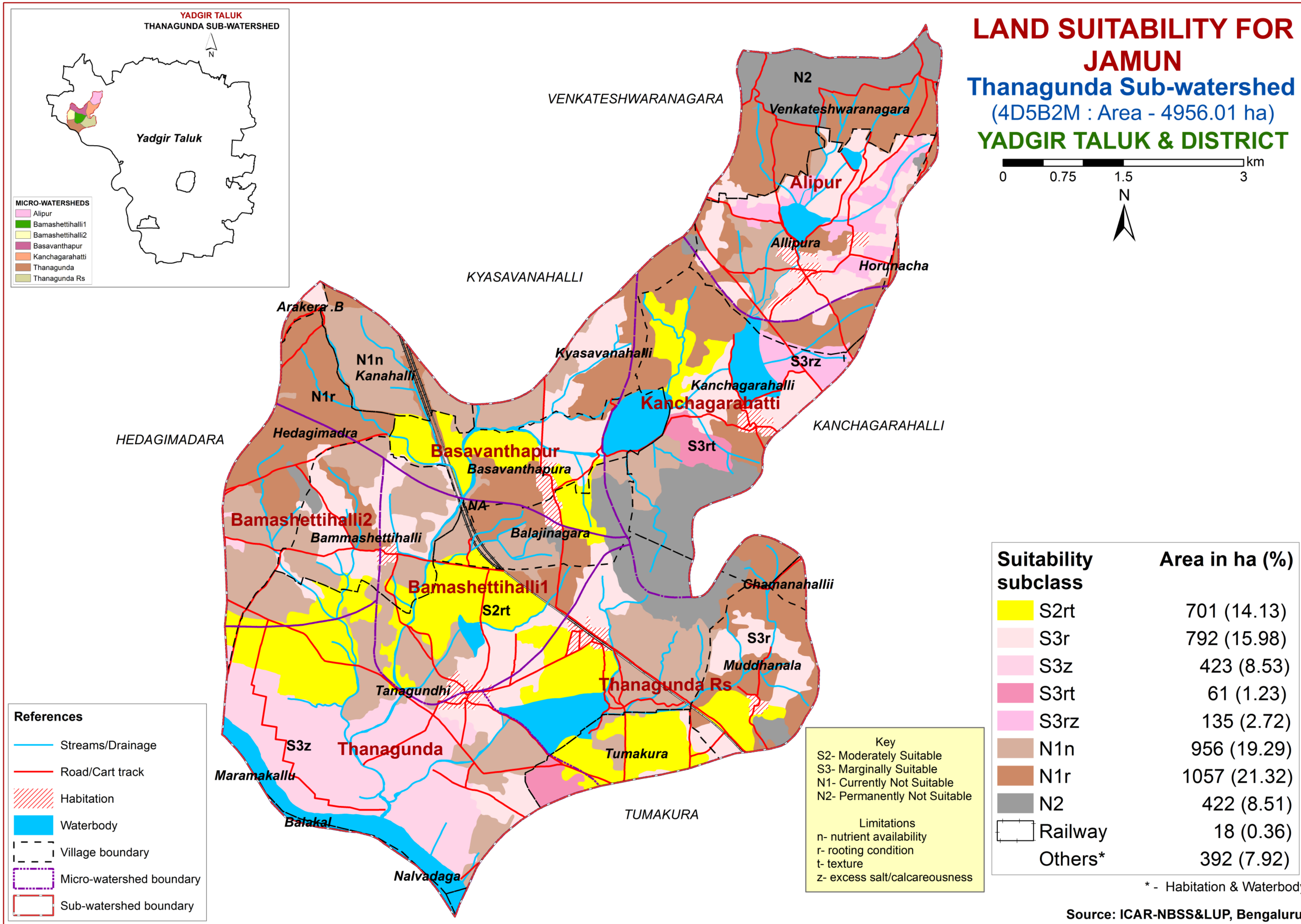
7.17. Land Suitability for Sapota



7.18. Land Suitability for Jackfruit



7.19. Land Suitability for Jamun

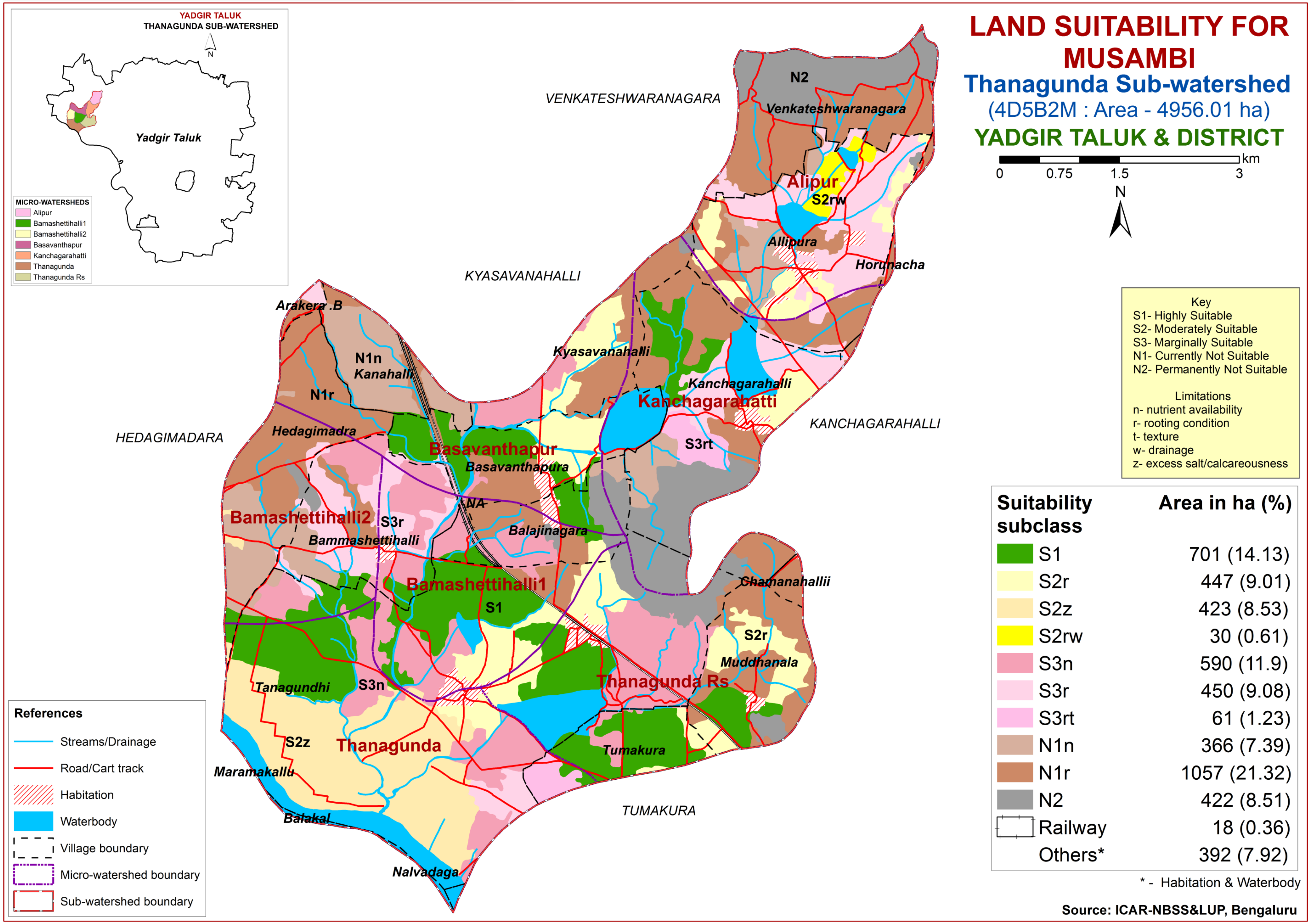


Suitability subclass	Area in ha (%)
S2rt	701 (14.13)
S3r	792 (15.98)
S3z	423 (8.53)
S3rt	61 (1.23)
S3rz	135 (2.72)
N1n	956 (19.29)
N1r	1057 (21.32)
N2	422 (8.51)
Railway	18 (0.36)
Others*	392 (7.92)

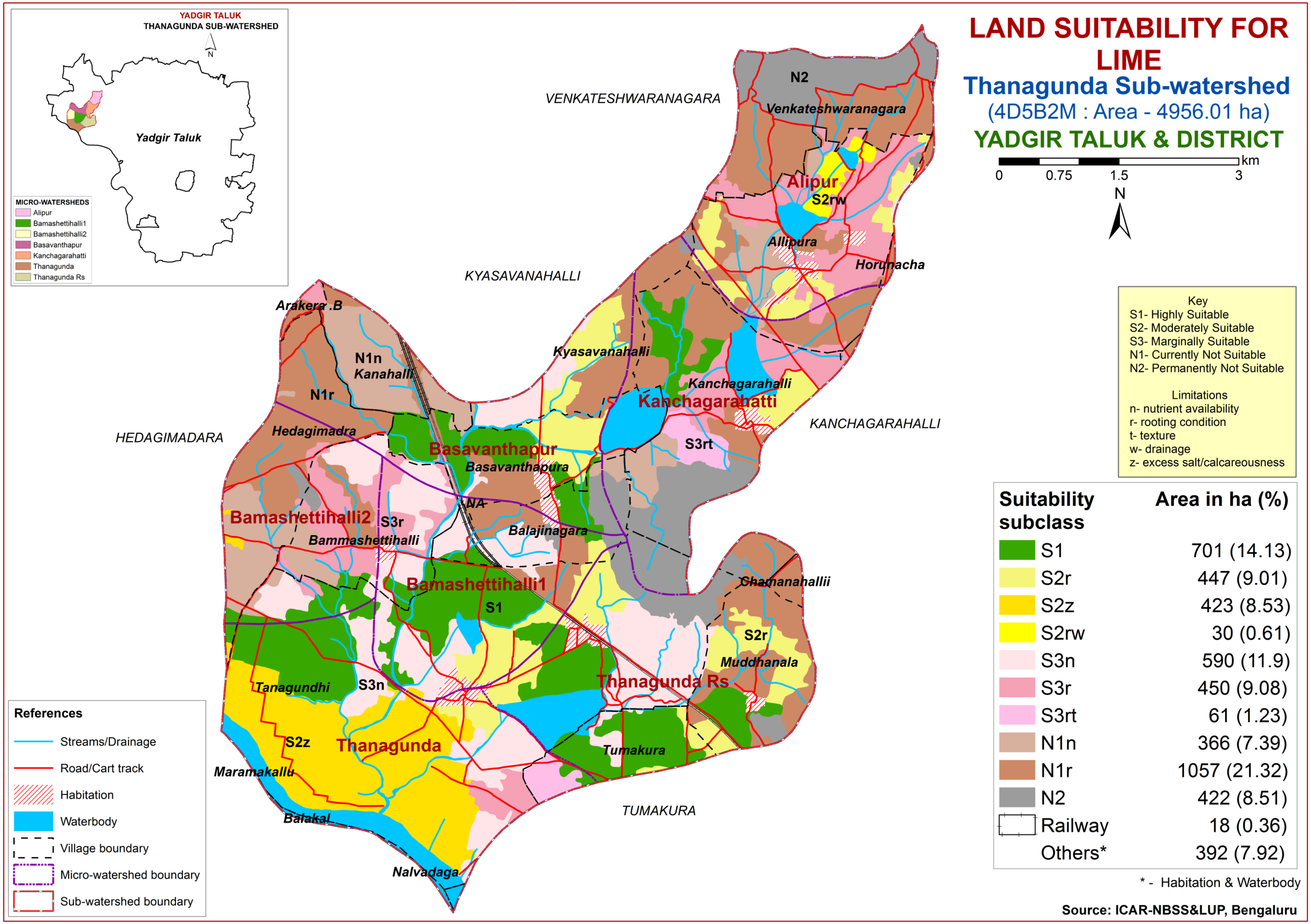
* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

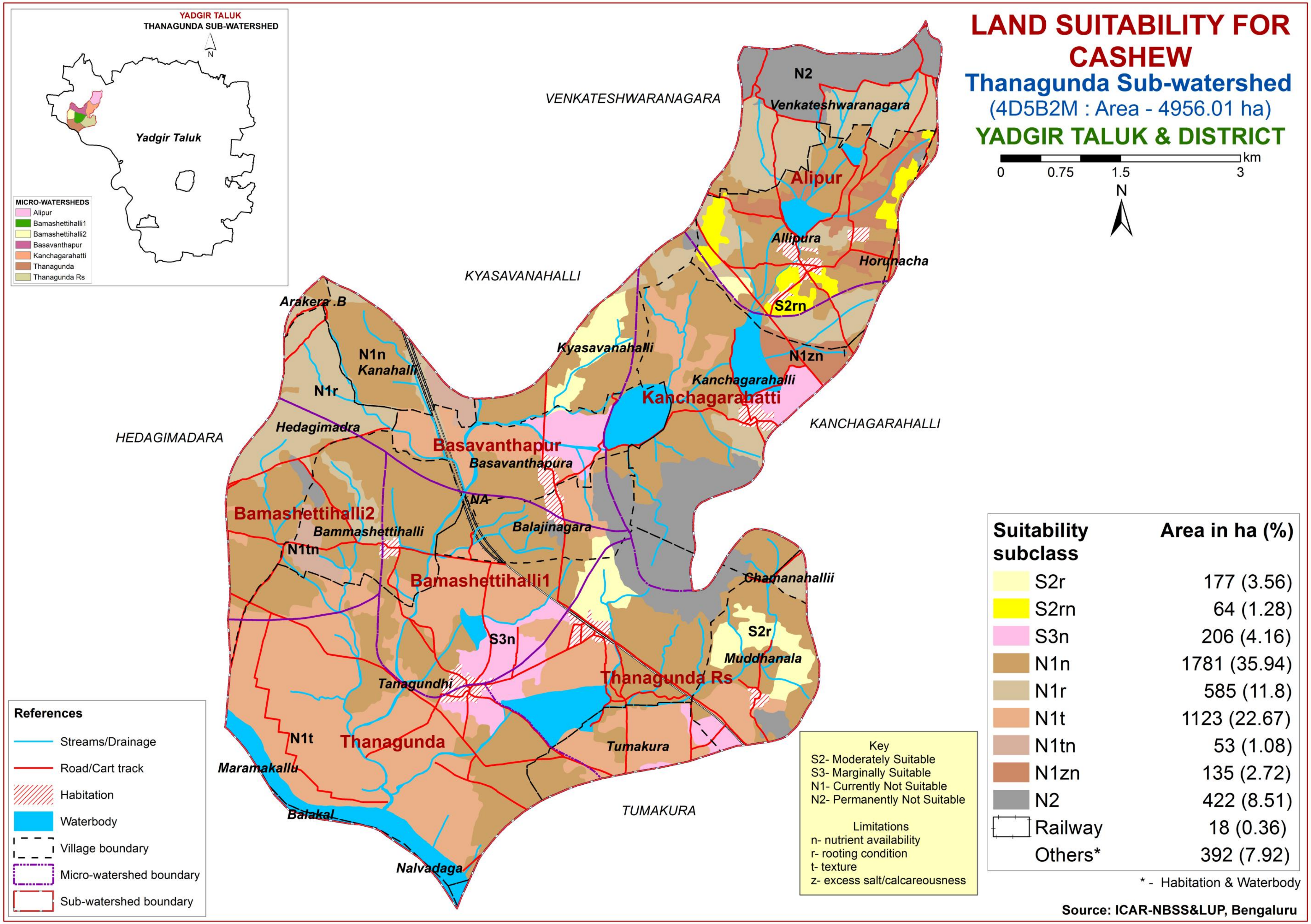
7.20. Land Suitability for Musambi



7.21. Land Suitability for Lime

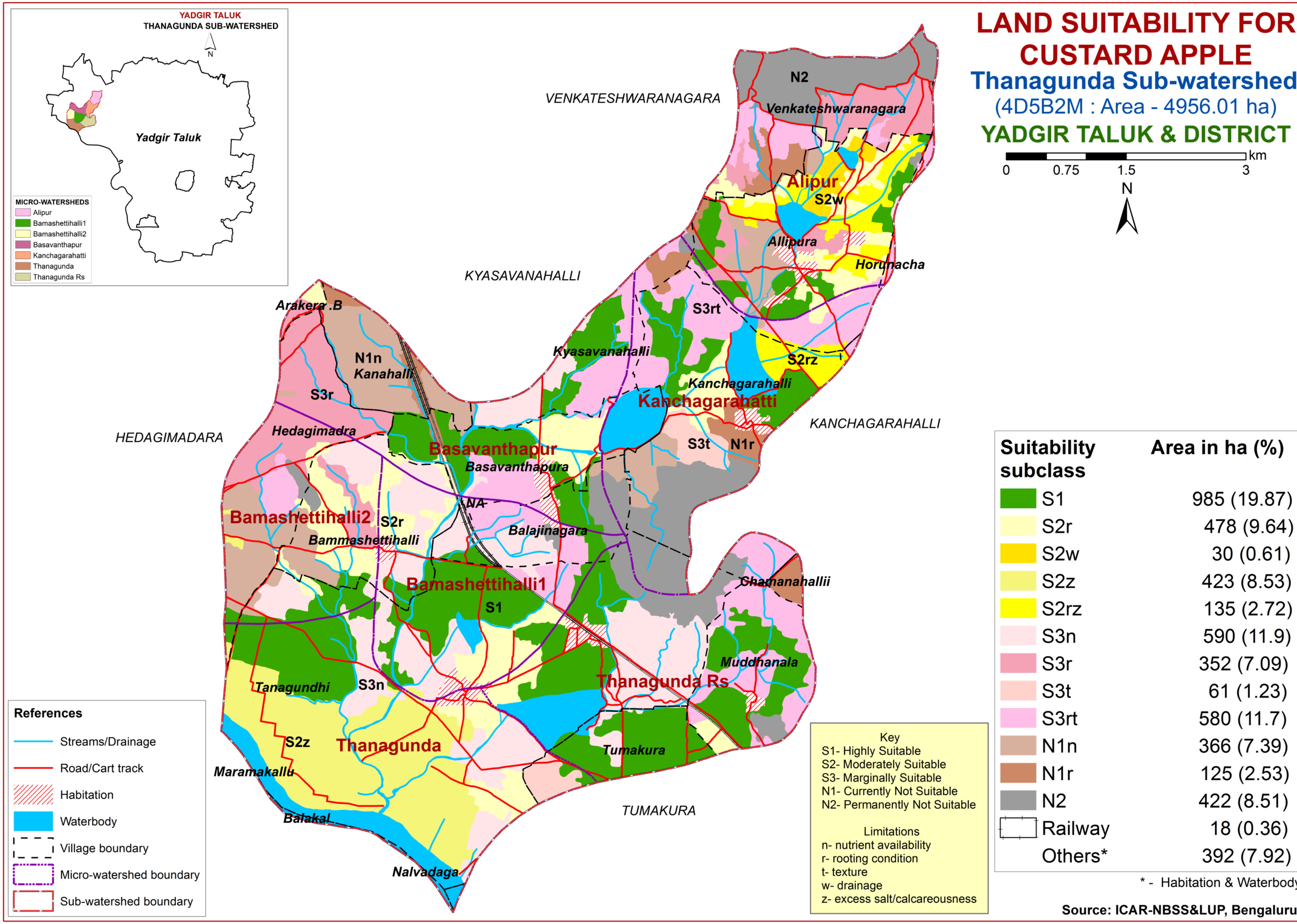


7.22. Land Suitability for Cashew

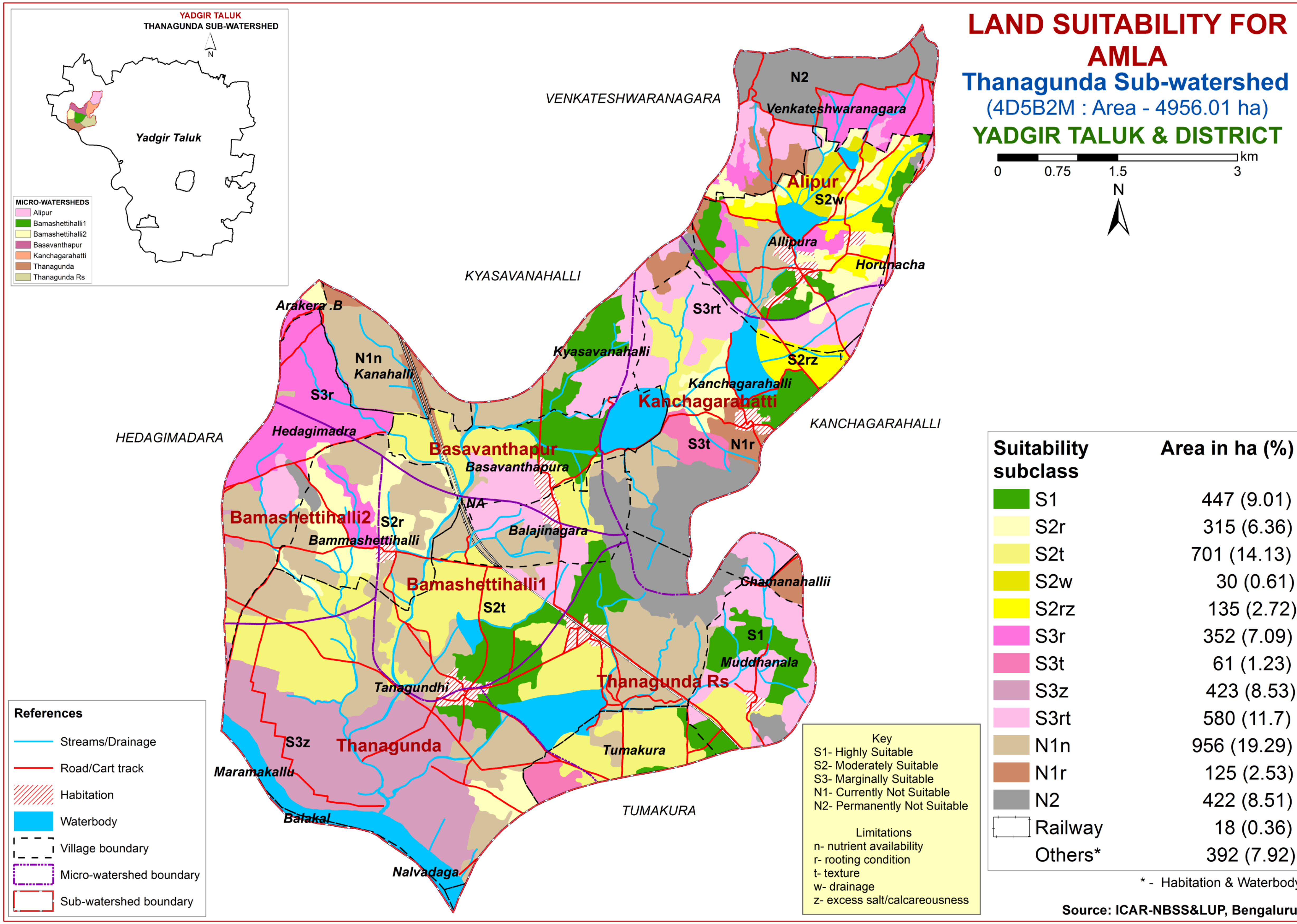


Suitability subclass	Area in ha (%)
S2r	177 (3.56)
S2rn	64 (1.28)
S3n	206 (4.16)
N1n	1781 (35.94)
N1r	585 (11.8)
N1t	1123 (22.67)
N1tn	53 (1.08)
N1zn	135 (2.72)
N2	422 (8.51)
Railway	18 (0.36)
Others*	392 (7.92)

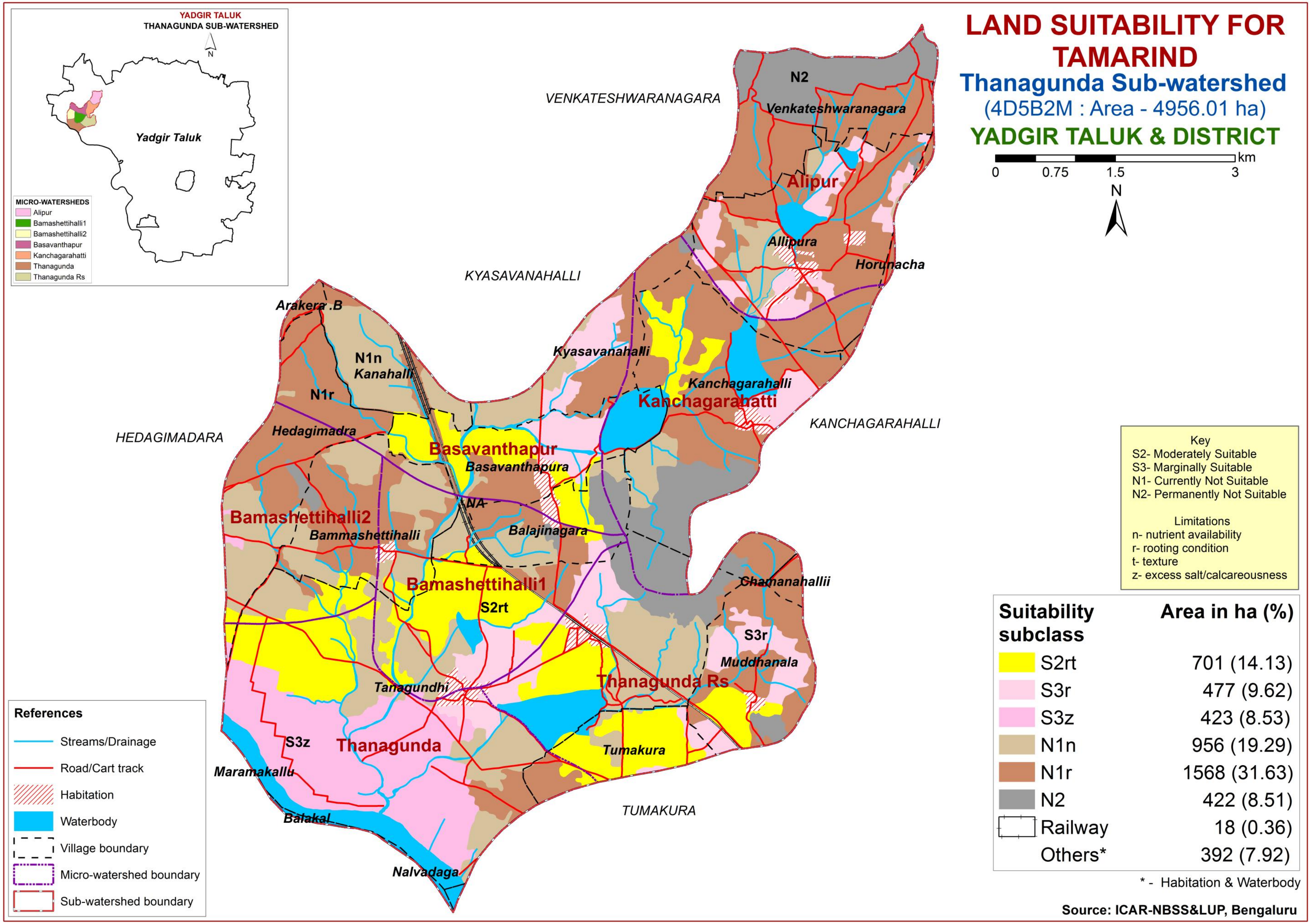
7.23. Land Suitability for Custard Apple



7.24. Land Suitability for Amla

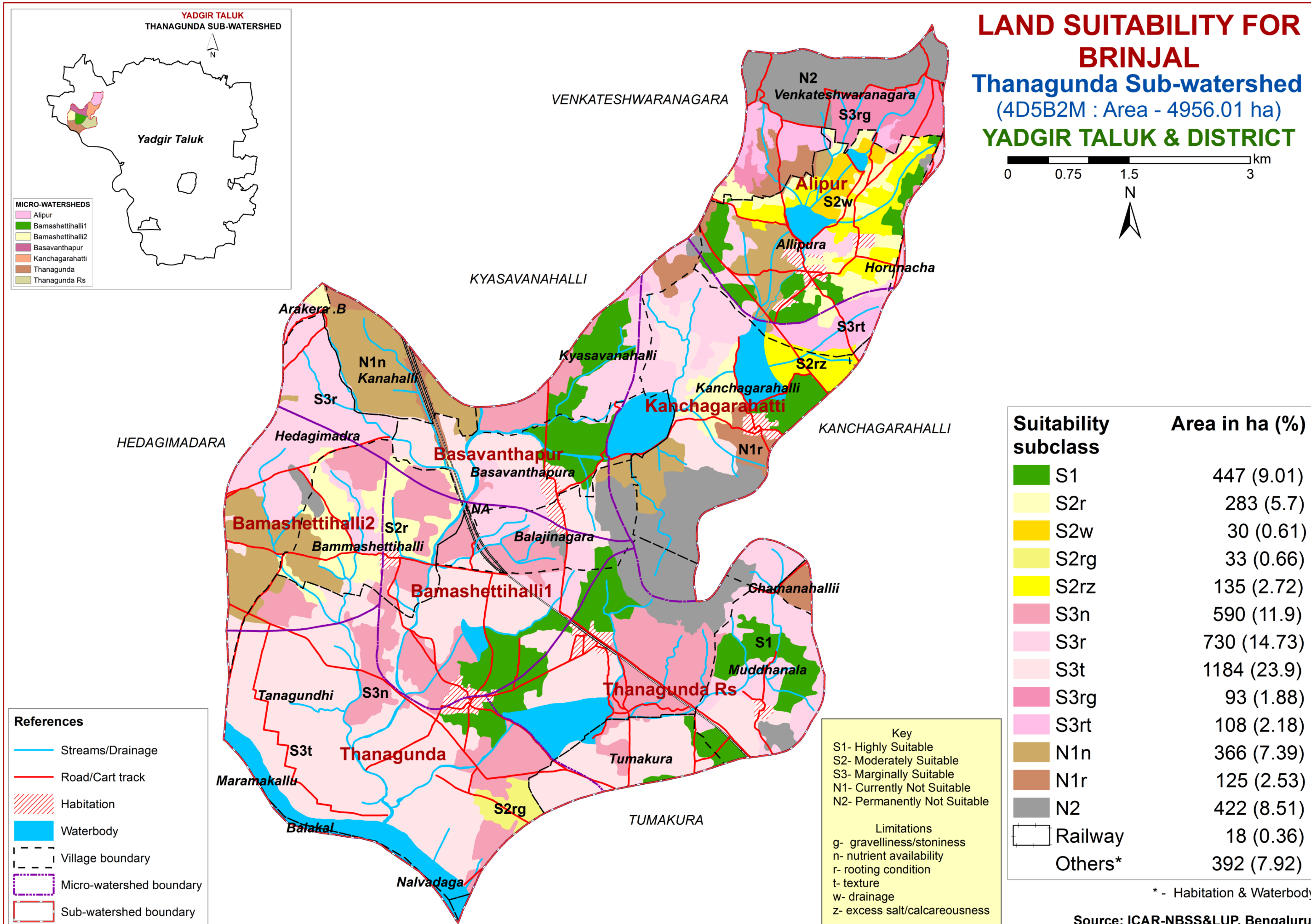


7.25. Land Suitability for Tamarind

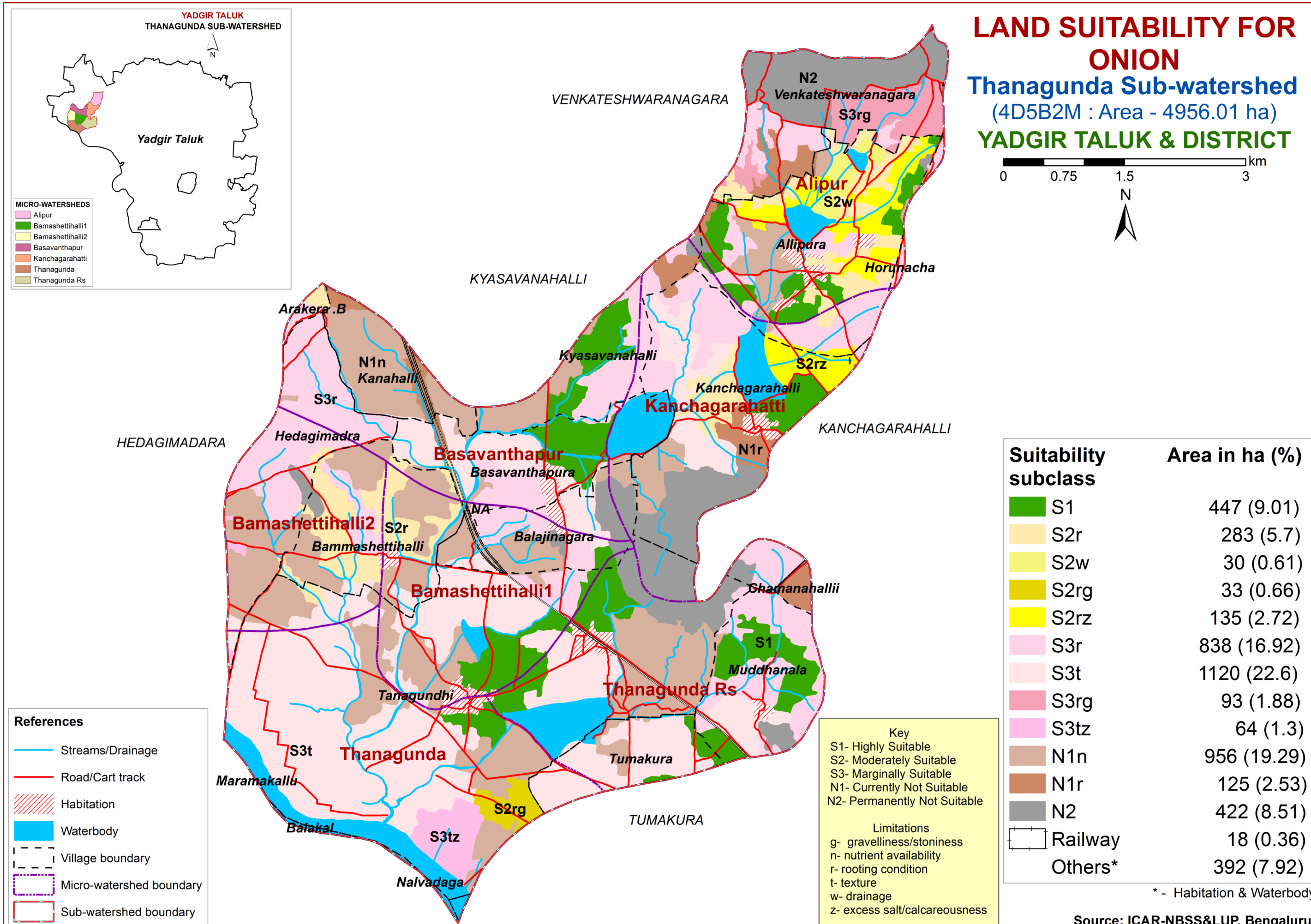


Suitability subclass	Area in ha (%)
S2rt	701 (14.13)
S3r	477 (9.62)
S3z	423 (8.53)
N1n	956 (19.29)
N1r	1568 (31.63)
N2	422 (8.51)
Railway	18 (0.36)
Others*	392 (7.92)

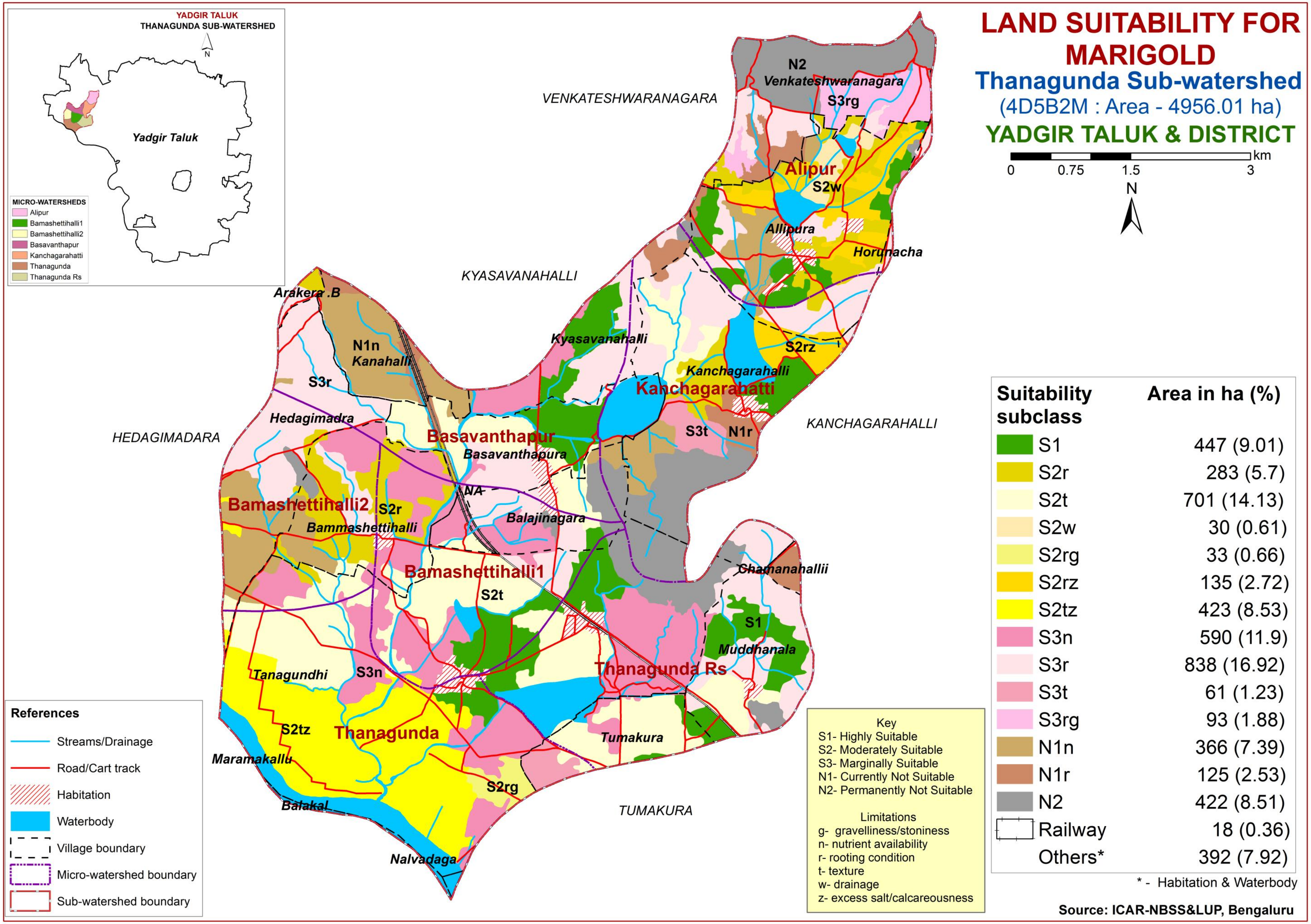
7.26. Land Suitability for Brinjal



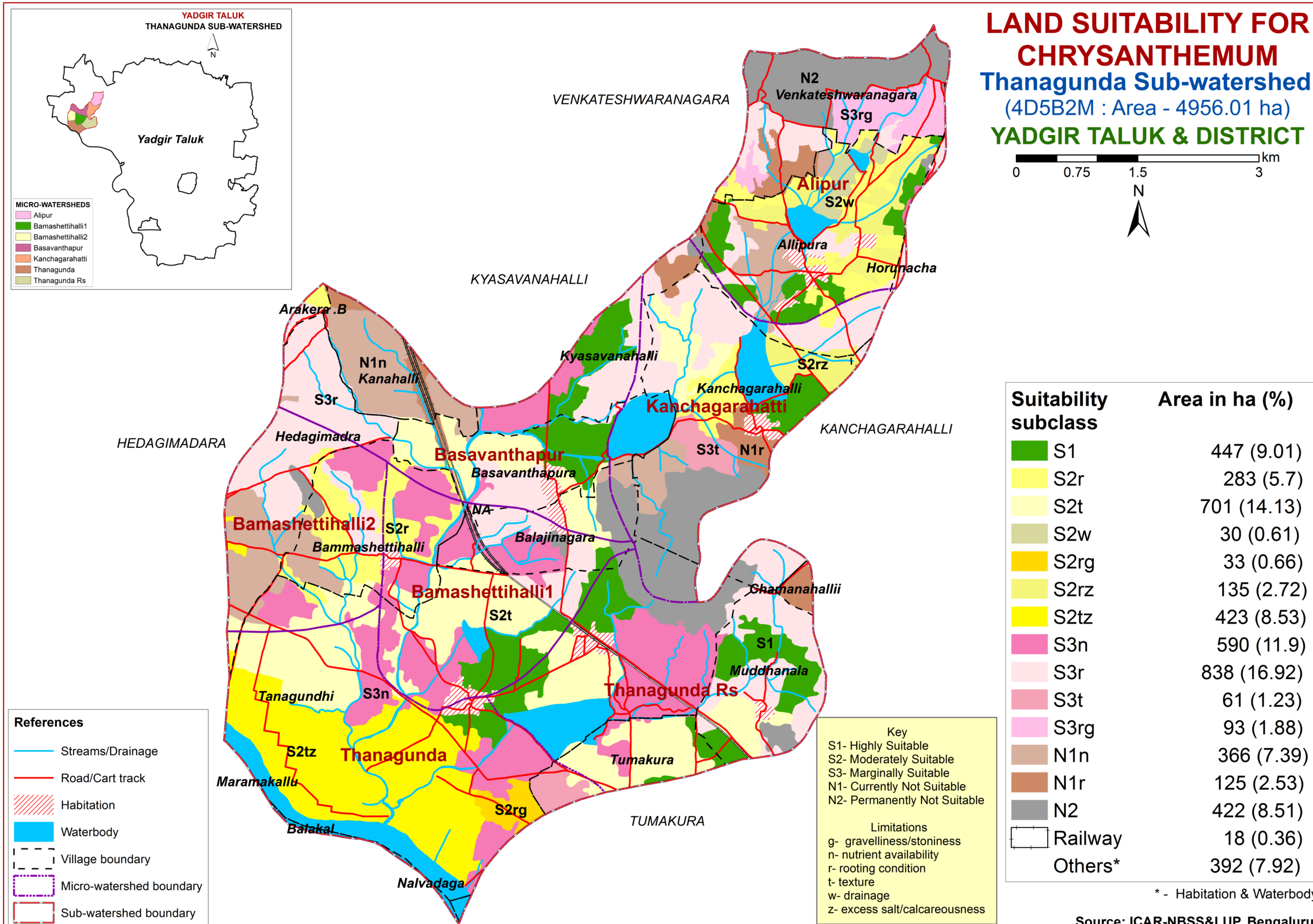
7.27. Land Suitability for Onion



7.28. Land Suitability for Marigold

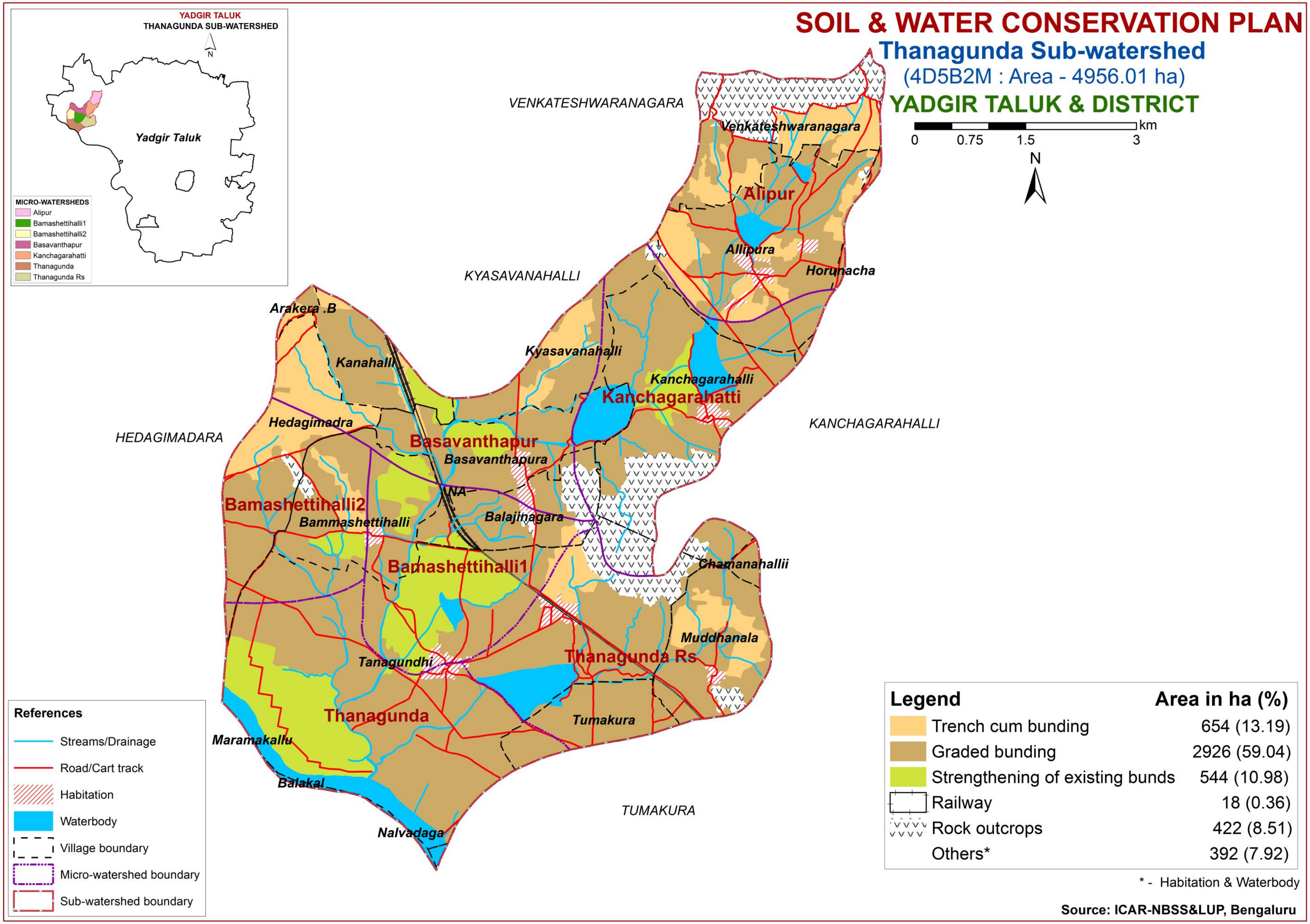


7.29. Land Suitability for Chrysanthemum



8. Soil and Water Conservation Measures

8.1. Soil & Water Conservation Plan



9. Table. Proposed Crop Plan for Thanagunad Sub-watershed, Hatthakuni Hobli, Yadgir Taluk, Yadgir District based on soil-site–crop suitability Assessment

LMU.No	Soil Map Units	Field Crops/Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
1	167.ANRcA1 55ANRiB2 34GWDcB2 35GWDiB2 (Sodic soils)	-	**Agri-Silvi-Pasture** Ber, Aonla, Acacia sp. Dhaincha, Rhodes grass, Para grass ,Bermuda grass	Application of gypsum, iron pyrites and elemental sulphur. Addition of farm yard manures, green manures and providing subsurface drainage
2	50.BGDbB2 177BGDiA1 115BGDmB2 151BGDmB2g1 111HSLbB2 126HSLhB2 33HSLiB2 49NGPmB2 128SHTcB2 112SHTmB2 (Moderately deep to deep, black sandy clay to clay soils)	Maize, Sorghum, Sunflower, Groundnut, Red gram, Bajra, Bengal gram, safflower, linseed	**Fruit crops:** Musambi, Sapota, Pomegranate, Amla, Custard apple, Guava, Jackfruit, Lime **Vegetables:** Tomato, Onion**,** Bhendi, Chilli, Brinjal, Drumstick, Coriander **Flowers:**Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
3	38BLCiB2 40PGPcB2 (Moderately deep, red sandy clay to sandy clay loam soils)	Sunflower, Sorghum, Maize, Groundnut, Red gram, Bajra	**Fruit crops:** Mango, Musambi, Sapota, Tamarind, Pomegranate, Amla, Custard apple, Guava, Jackfruit, Jamun, Lime **Vegetables:** Tomato, Onion**,** Bhendi, Chilli, Brinjal, Drumstick, Coriander **Flowers:**Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
4	159BMNmA1 62BMNmB2 57.MDGcB2 148.MDGhB2 58.MDGiB2 59.MDRcB2 132.MDRhB2 60.MDRiA1 133.MDRiB2 (Deep to very deep, strongly alkaline soils)	Sorghum, Maize, Bajra	**Agri-Silvi-Pasture** Ber, Aonla, Acacia sp. Dhaincha, Rhodes grass, Para grass ,Bermuda grass	Application of gypsum, iron pyrites and elemental sulphur. Addition of farm yard manures, green manures and providing subsurface drainage

To be continued….

LMU.No	Soil Map Units	Field Crops/Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
5	116.KDHiB2 (Moderately deep , lowland sandy clay soils)	Maize, Sorghum, Sunflower, Groundnut, Red gram, Bajra	**Fruit crops:** Amla, Tamarind **Vegetables:** Tomato, Onion**,** Bhendi, Chilli, Brinjal, Drumstick,, Coriander **Flowers:** Marigold, Chrysanthemum	Providing proper drainage, addition of organic manures, green leaf manuring, suitable conservation practises
6	11.SBRcB2 (Moderately shallow, loamy sand soils)	-	**Agri-Silvi-Pasture:** Hybrid Napier, *Styloxanthes hamata*, *Styloxanthes scabra*	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
7	14.HLGbB2g1 17.HLGiB2 178.JNKbB2g2 166.JNKcA1 20.JNKcB2 (Moderately shallow, sandy clay loam soils)	Maize, sorghum Groundnut, Bajra	**Fruit crops:** Amla, Custard apple **Vegetables:** Tomato, Chilli, Brinjal, Bhendi, Onion **Flowers:**Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
8	2.BDLbB2 3.BDLbC3 4.BDLhB2 162.BDLhB2g1 121.DSBcB2 108.DSBiB2 156.HTKbB2 161.HTKbB2g1 8.VNKbB2g1 9.VNKcB2 10.VNKiB2 (Shallow soils)	**-**	**Agri-Silvi-Pasture:** Hybrid Napier, *Styloxanthes hamata,* Dhaincha, Sunhemp, Glyricidia*, Styloxanthes scabra*	Use of short duration varieties, sowing across the slope and split application of nitrogen fertilizers
9	118.BDPcB2 153.KKRbB2g1 175.KKRcB2 (Very shallow soils)	-	Hybrid Napier, *Styloxanthes hamata*, *Styloxanthes scabra*	Use of short duration varieties, sowing across the slope

PART - B

Hydrological Inventory of Thanagunda Sub-watershed, Yadgir Taluk, Yadgir 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 Thanagunda Sub-watershed, Yadgir Taluk, Yadgir 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

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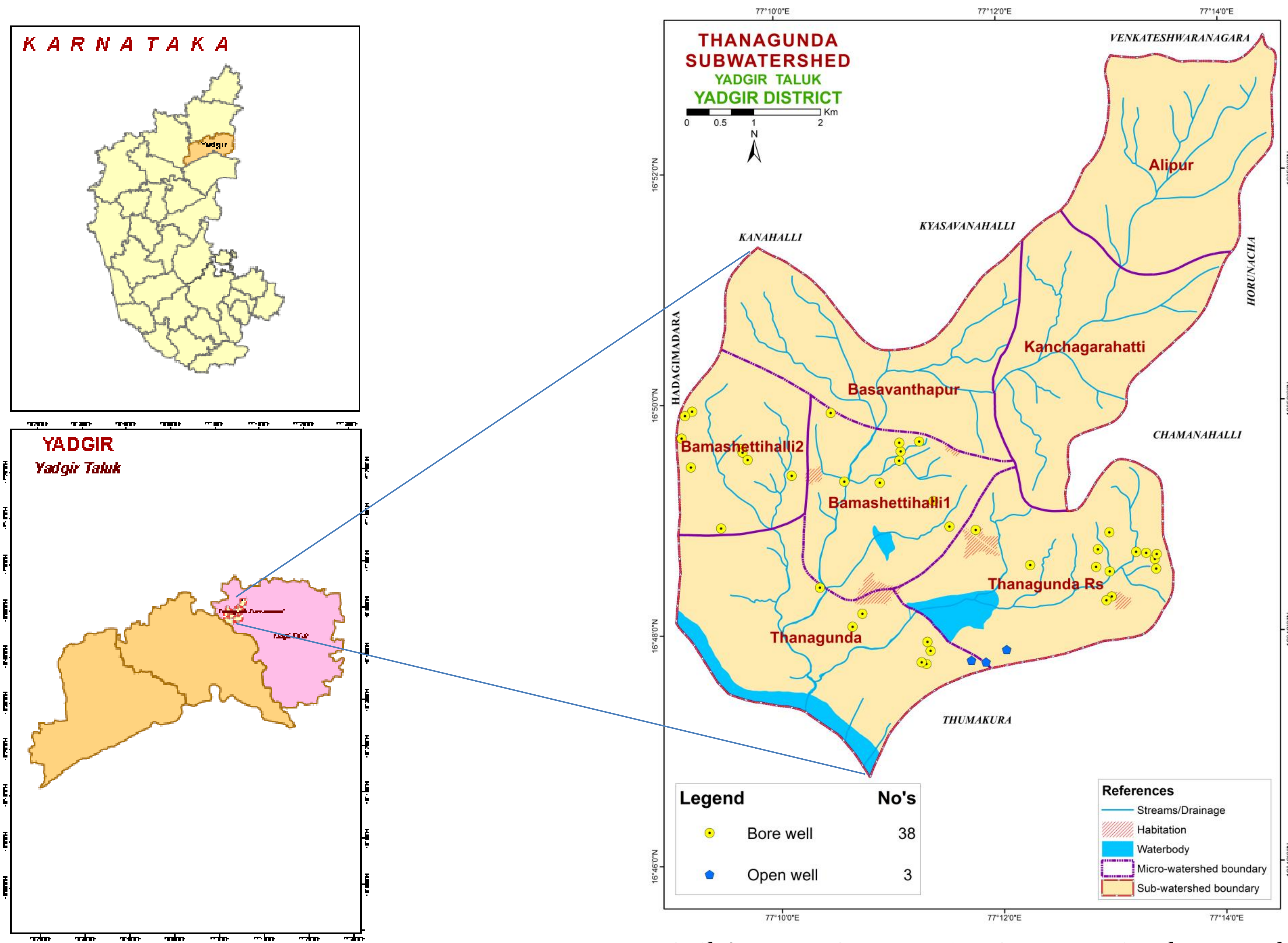
INTRODUCTION

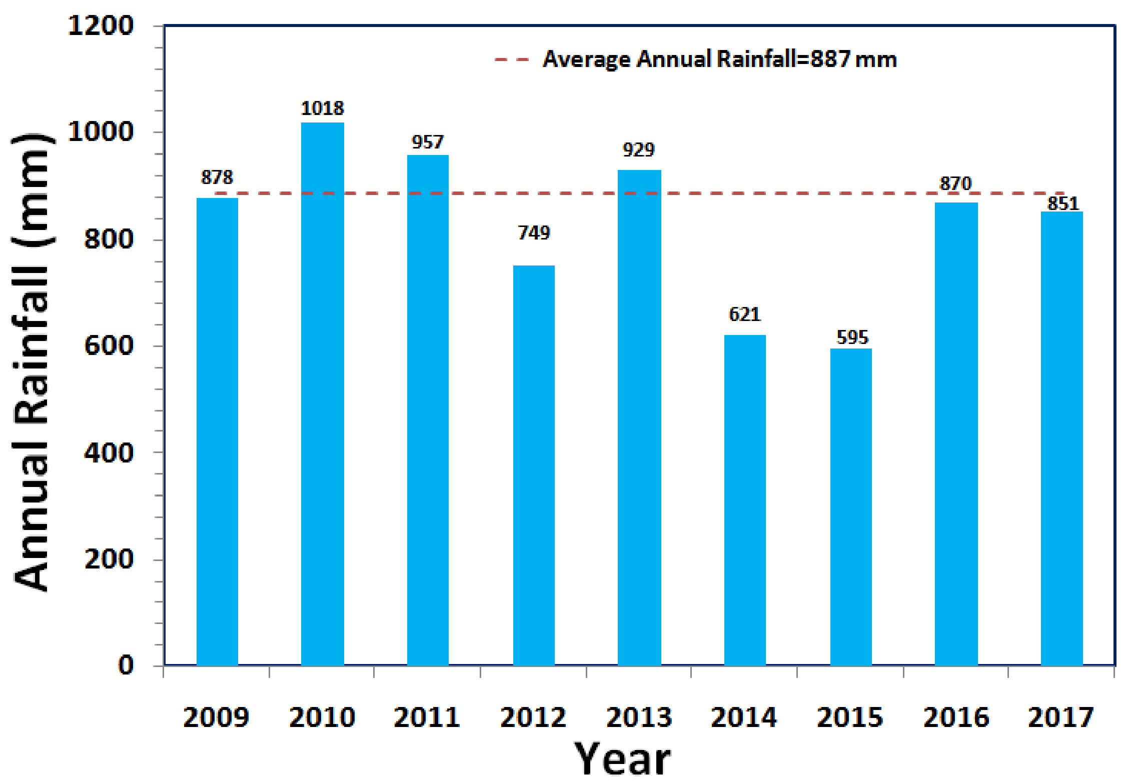
- The inventory and documentation of spatial and temporal changes in hydrological components of Thanagunda sub-watershed (4D5B2M) in Yadgir Taluk, Yadgir District, has been undertaken for integrated planning, development and management.
- Thanagunda sub-watershed (Yadgir Taluk, Yadgir District) is located between 16^{0}46’15’’- 16^{0}52’18’’ North latitudes and 77^{0}1’34’’- 77^{0}6’42’’ East longitudes, covering an area of about 4956.01 ha.
- This sub-watershed encompasses of 7 MWs namely Alipur (4D5B1B1e), Bamashettihalli-1 (4D5B1B1d), Bamashettihalli-2 (4D5B1B1b), Basavanthapur (4D5B1B1c), Kanchagarahatti (4D5B1B2c), Thanagunda (4D5B1B2a) and Thanagunda Rs (4D5B1B1a). Land Resource Inventory (LRI) was generated for all the seven micro-watersheds.
- Average annual rainfall (1960-2014) of the Hobli (Block) pertaining to the sub-watershed is 887 mm.
- In this sub-watershed major *kharif* crops grown are Maize, Cotton, Sunflower, Groundnut, Red gram, Chilly, Soybean , Paddy and major *rabi* crops are Sorghum, Bengalgram, Bajra.
- 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 THANAGUNDA SUB-WATERSHED



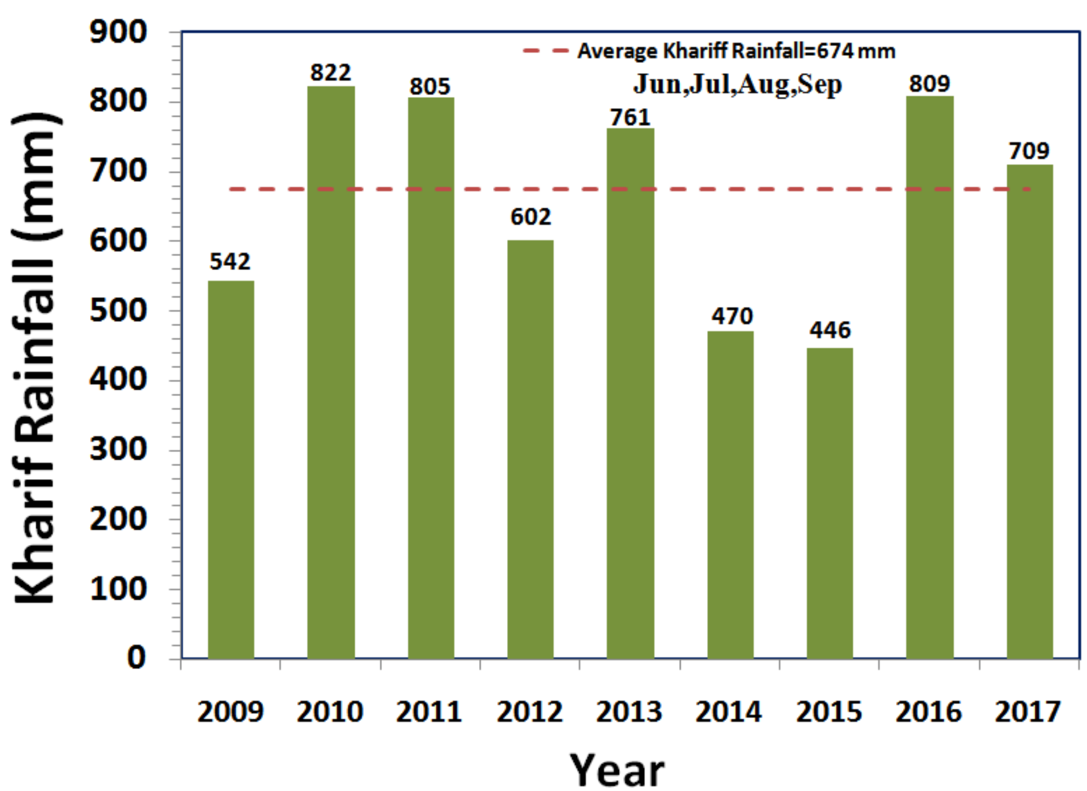
Soil & Water Conservation Structures in Thanagunda sub-watershed, Yadgir Taluk, Yadgir District

RAINFALL INDEX

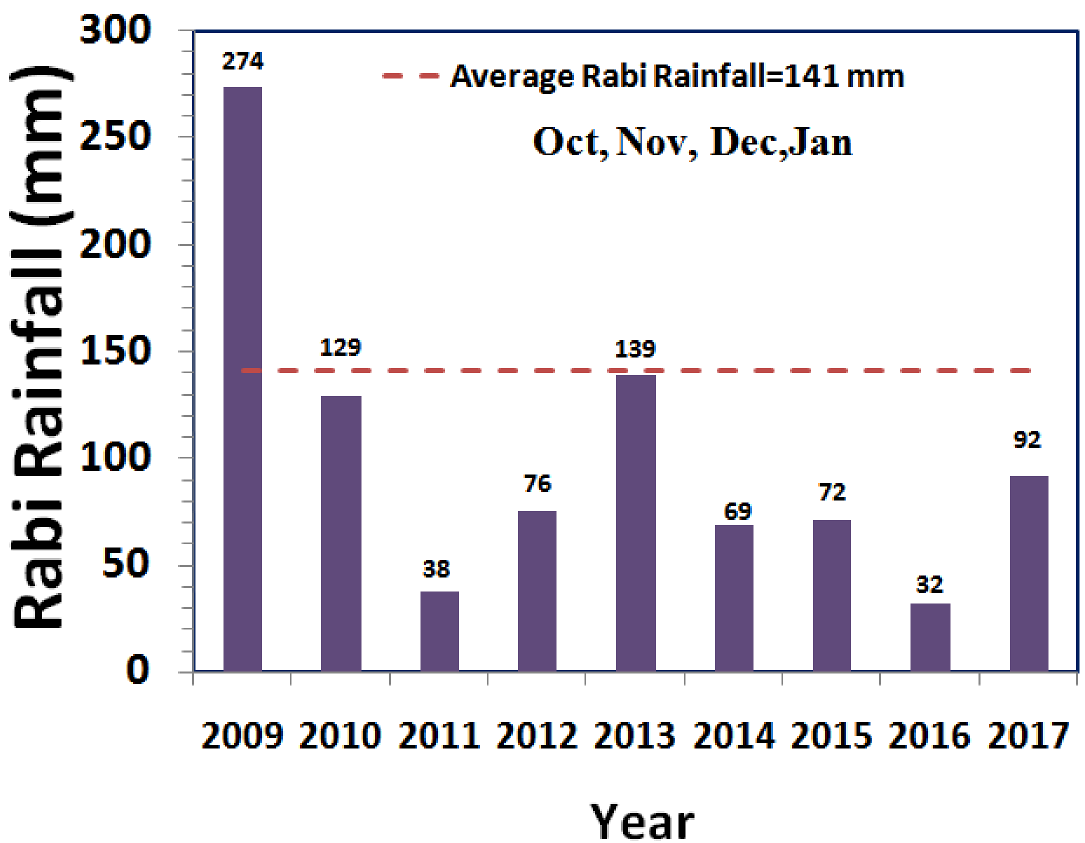


The average annual rainfall (1960-2014) recorded at the Yadgir station in Yadgir taluk of Yadgir district is 887 mm. The annual rainfall at Hattikuni station (Hobli H.Q.) is presented. During the years 2012, 2014, 2015, 2016 and 2017 the annual rainfall was deficient by 22%, 42%, 46%, 3% and 6% respectively.

The *kharif* rainfall (Jun–Sep) is an average about 80% of the annual rainfall and it typically follows the annual rainfall patterns. During the years 2009, 2012, 2014 and 2015 the annual rainfall was deficient by 20%. 11%. 30% and 34% respectively.

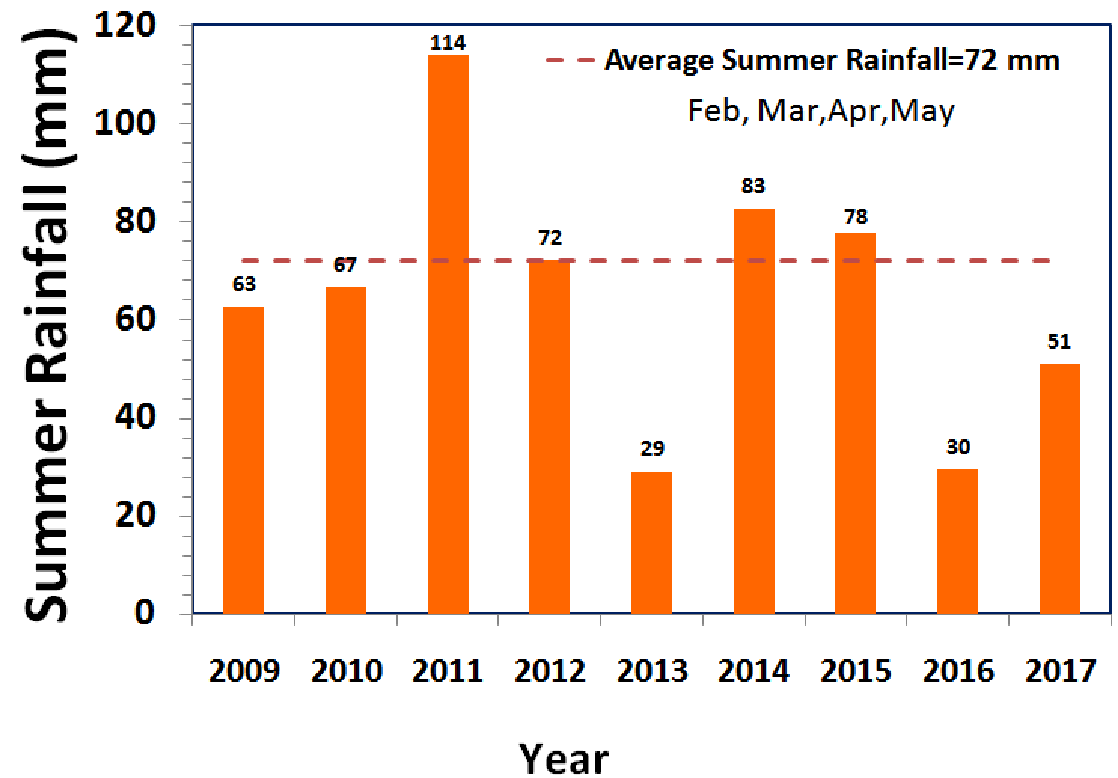


RAINFALL INDEX

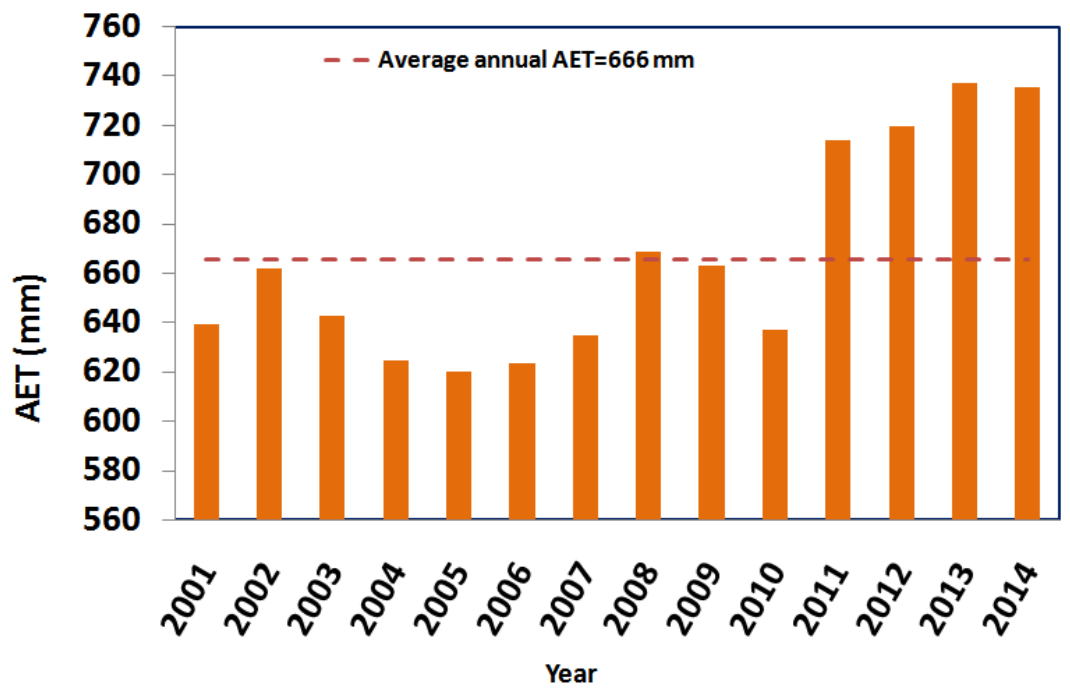


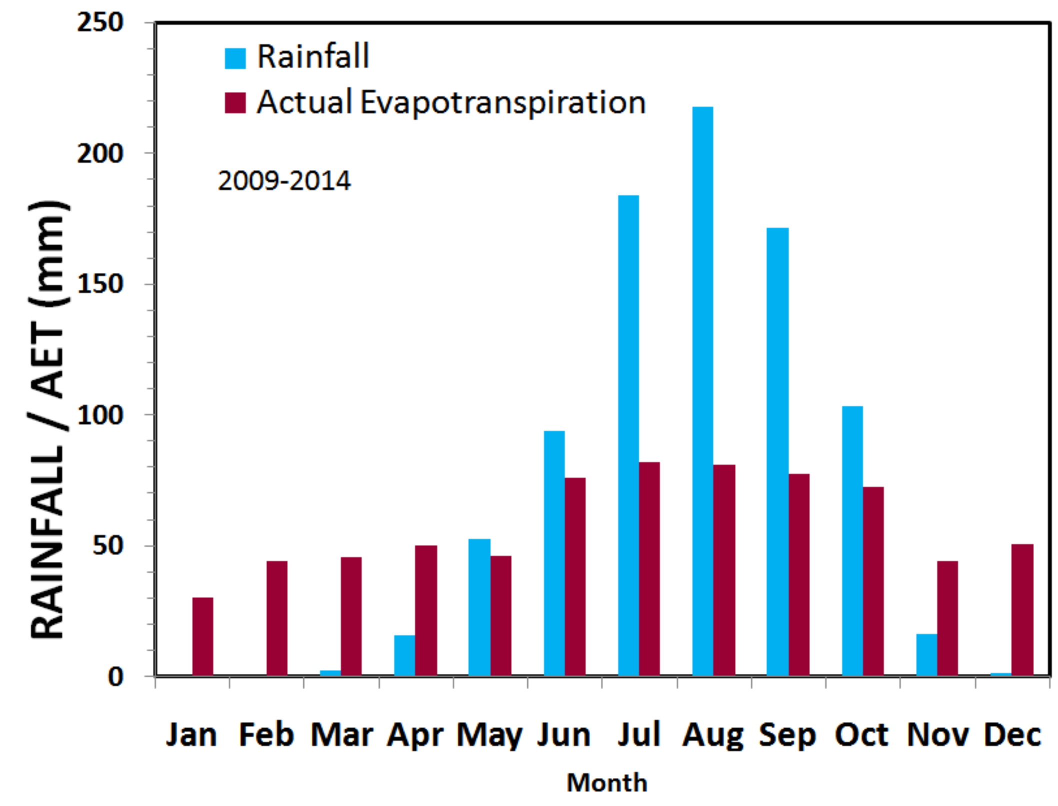
The average *rabi* rainfall (Oct-Jan) is about 12% of the Average annual rainfall. During the year 2009 high *rabi* rainfall was received, where as other years showed deficient rainfall.

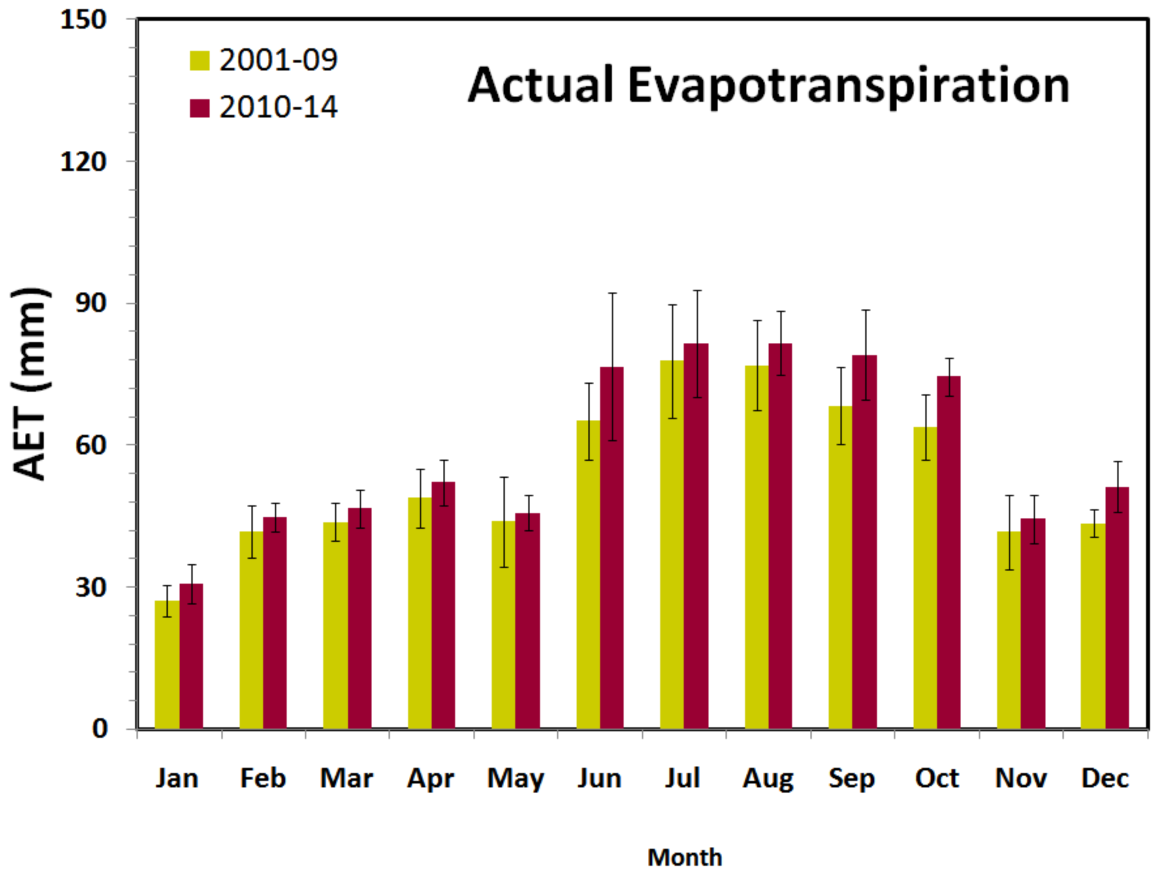
The average summer rainfall (Feb-May) is about 8% of the average annual rainfall.



EVAPOTRANSPIRATION

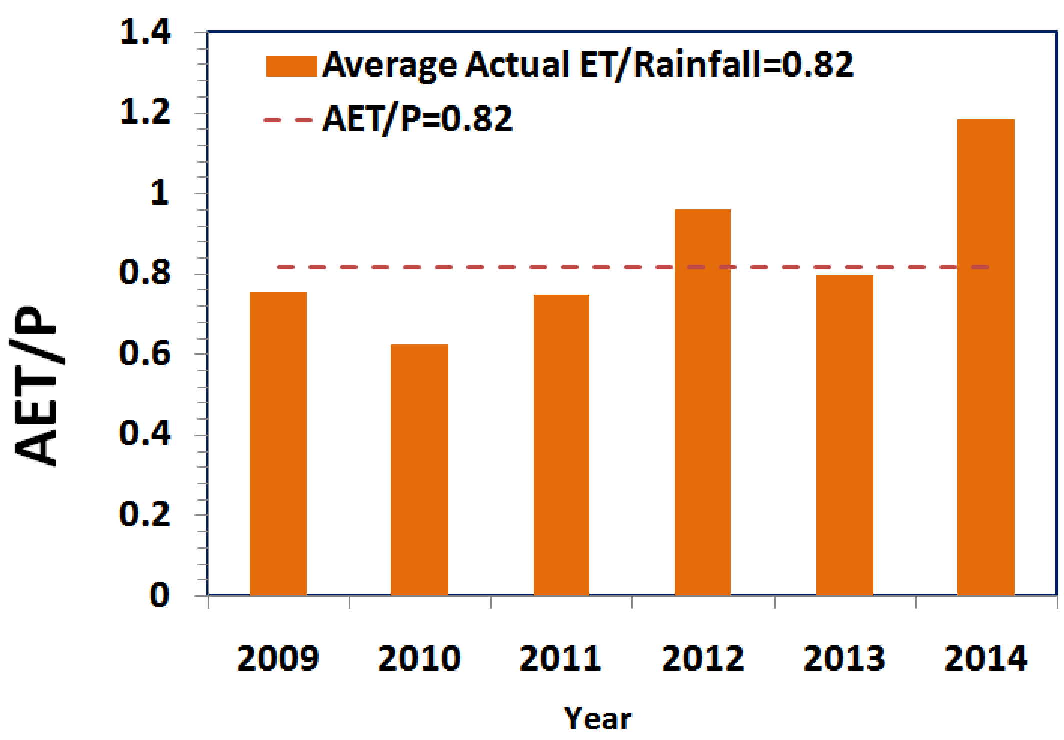


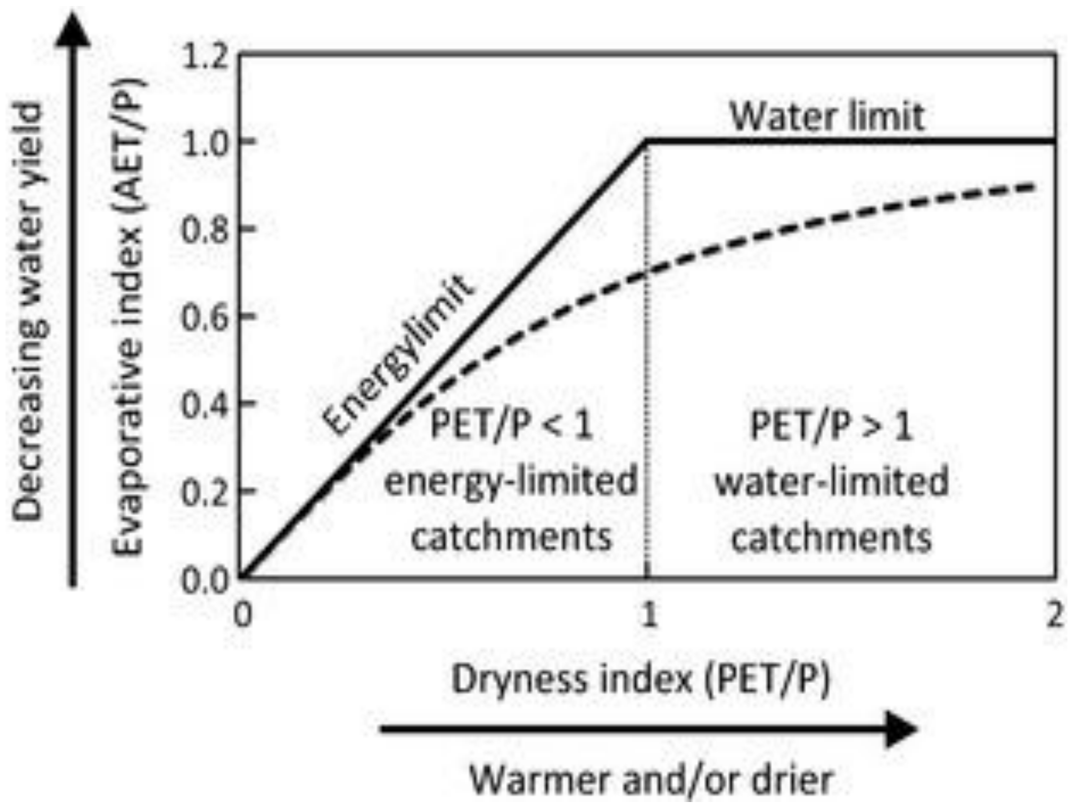




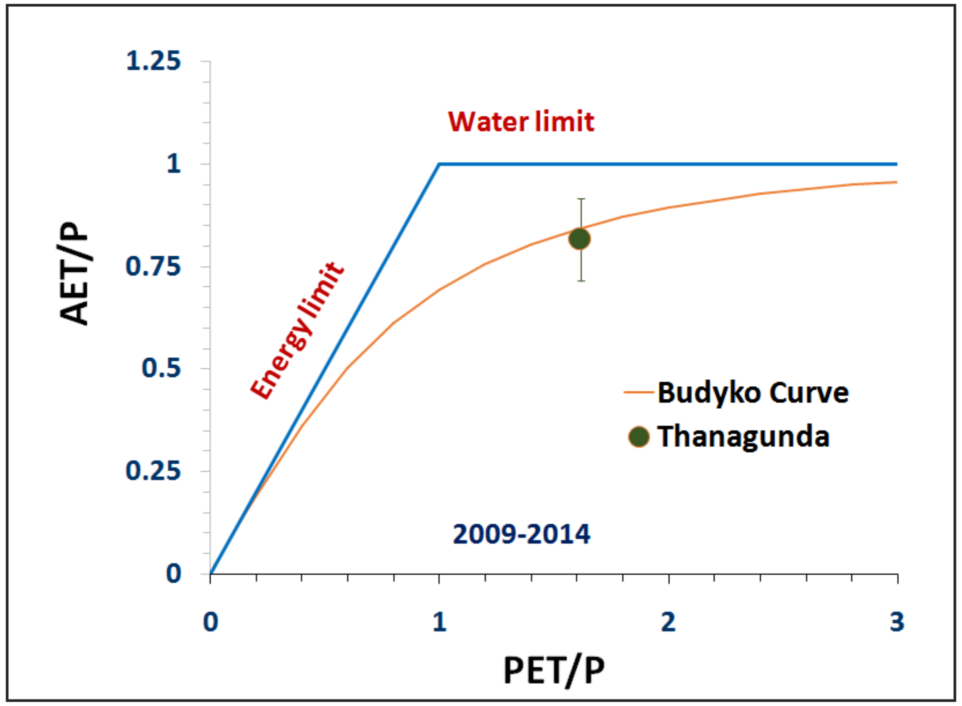
The average annual actual ET is lower than the average rainfall. During *kharif*, average rainfall and AET was found to be 674 mm and 316 mm respectively, whereas in *rabi* it was about 141 mm and 198 mm. The annual ET increased by 9% during 2010-2014 compared to 2001-2009 .

EVAPOTRANSPIRATION INDEX

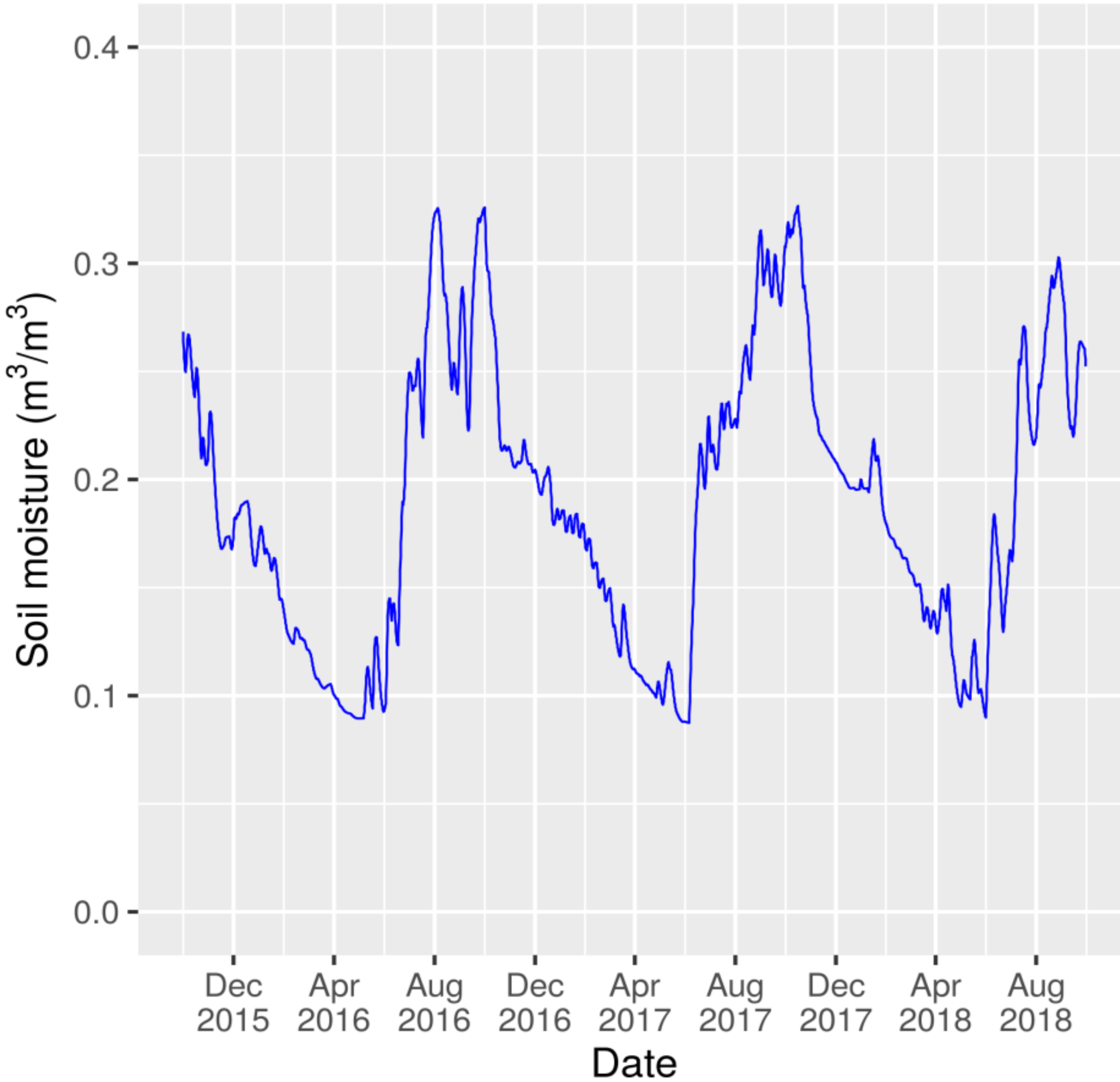


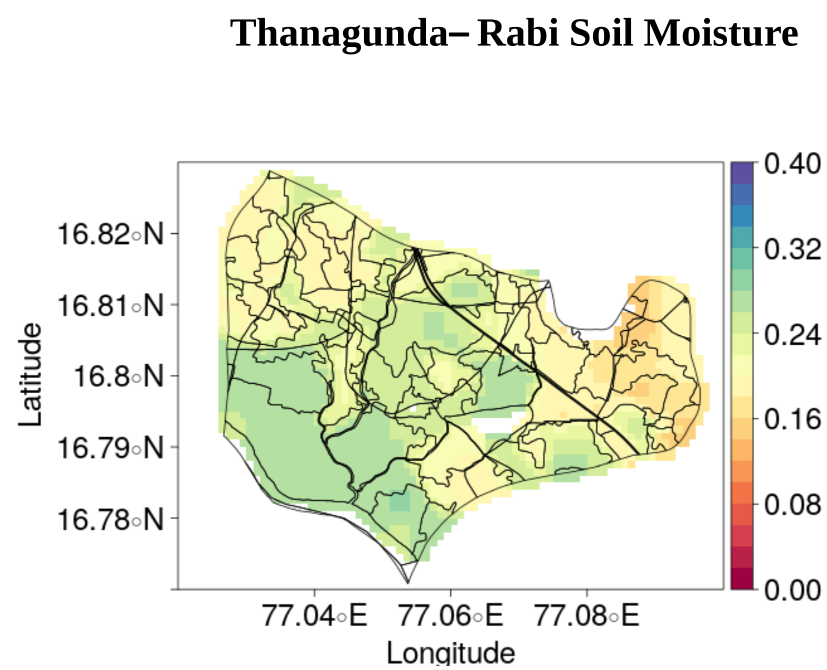


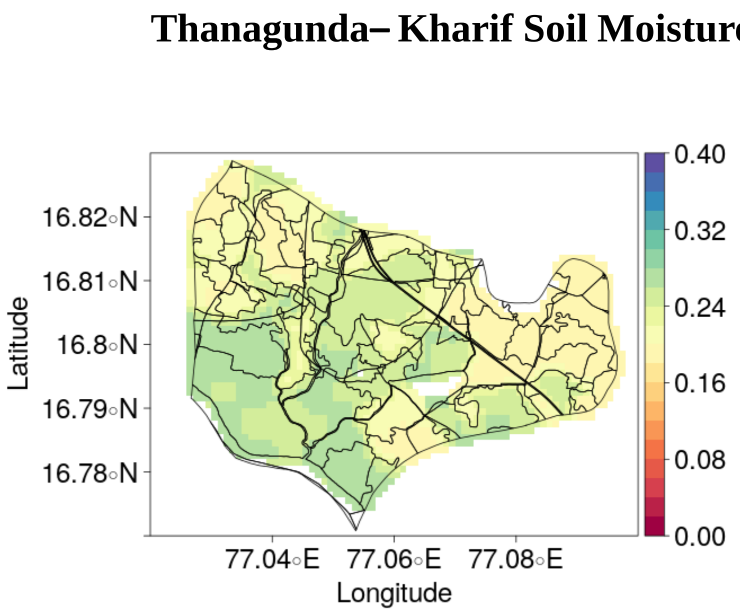
The average AET/P ratio was about 82%, which is slightly higher than the sustainable limit of about 80%. Even during extremely lower rainfall year of 2001, AET was 720 mm. This suggests the presence of water storage and utilization from other sources such as groundwater, which buffered the lower rainfall.



SATELLITE RETRIEVED SOIL MOISTURE





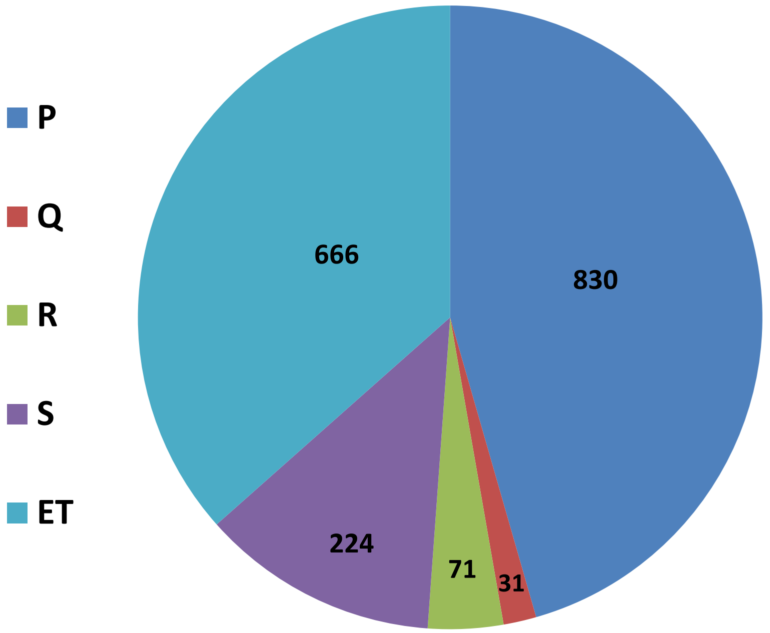


The method developed for retrieving soil moisture from multi-satellite observations allowed to map surface soil moisture behavior in the micro-watershed. The available surface moisture was varied in the range of 9-28 % in *kharif* and 17-33% in *rabi* seasons of 2016 and 8-31% in *Kharif* and 18-32% in *rabi* seasons of 2017.

WATER BALANCE

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

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

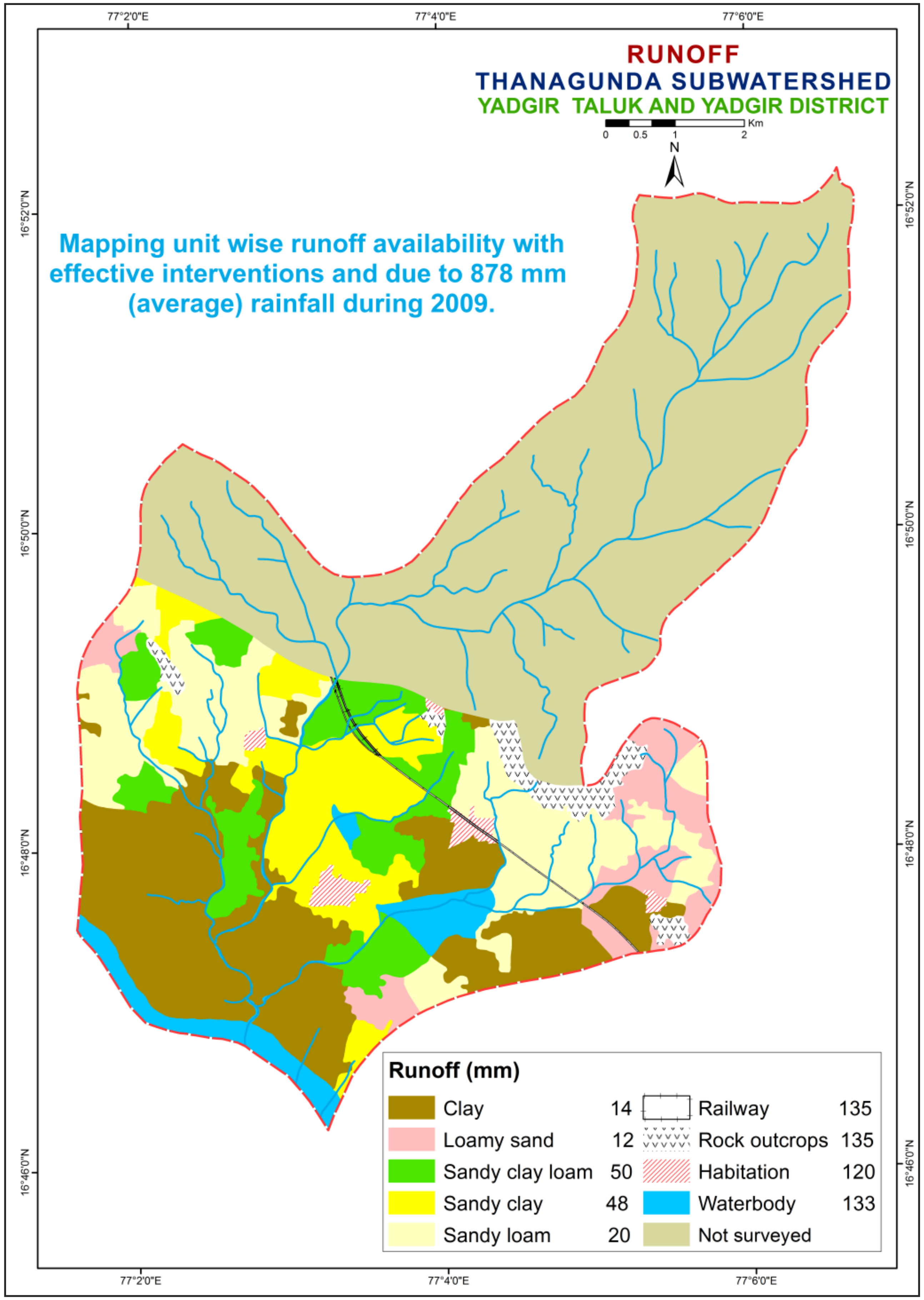


During June-October months, Precipitation is higher than Evapotranspiration, hence Runoff can occur in the watershed.

P = 830 mm (average of 2009-2017) ET = 666 mm R = 71 mm S = 224 mm Q = 31 mm

Sl. No.	Parameters	Average_ 2009 (mm)
1.	Rainfall	878
2.	Runoff availability with existing conditions	88
3.	Runoff availability with effective interventions	38
4.	Runoff allowed as environmental flow at the outlet	7
5.	Runoff excess for harvesting by construction of structures	31

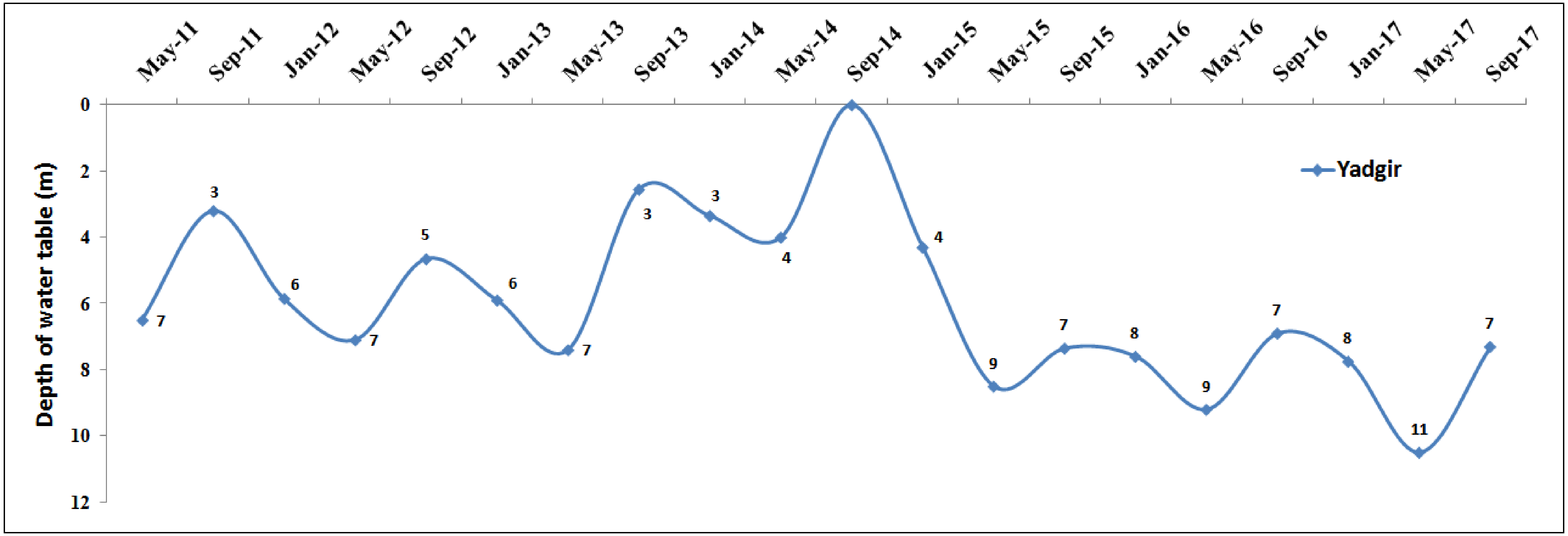
RUNOFF



77°2'0"E
77°4'0"E
77°6'0"E
16°52'0"N
16°50'0"N
16°48'0"N
16°46'0"N
RUNOFF
THANAGUNDA SUBWATERSHED
YADGIR TALUK AND YADGIR DISTRICT
0 0.5 1 2 Km
N
Mapping unit wise runoff availability with effective interventions and due to 878 mm (average) rainfall during 2009.
Runoff (mm)
Clay 14
Loamy sand 12
Sandy clay loam 50
Sandy clay 48
Sandy loam 20
Railway 135
Rock outcrops 135
Habitation 120
Waterbody 133
Not surveyed

GROUND WATER STATUS

YADGIR STATION



The total number of wells present in Thanagunda Sub-watershed as per LRI data is 41 wells (38 Bore wells & 3 open well). The groundwater level shown above is from the data obtained from Dept. of Mines & Geology for the nearest station Yadgir. The graph depicts the groundwater level during the years 2011-2017 were slightly varying, where as during the year 2014 was found constant.

SUMMARY

- The average annual rainfall of 887 mm in the Thanagunda sub-watershed as recorded from the Balichakra station data.

- 80%, 12% and 8% 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 sustainable condition.

- The estimated runoff available to use is 31 mm for an average annual rainfall of 830 mm (2009-2017). The utilizable groundwater is 49.7 mm (70% of 71 mm recharge estimated). This means the total available water resource combining the soil moisture store for kharif & rabi (224 mm) and utilizable runoff plus recharge is 305 (=224+31+50)

- The average actual evapotranspiration estimated in the watershed based on the current land use and irrigation practices for the kharif and rabi seasons is 514 mm. Hence the amount of water use for kharif and rabi seasons may be estimated as 642 mm (i.e. 125% of AET). This demand for the two seasons is higher by 337 mm, i.e. (642-305). The AET in June-Sept months is only 47% 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 Thanagunda Sub-watershed as per LRI data is 41 wells (38 Bore wells & 3 open well). The groundwater level data obtained from Dept. of Mines & Geology for the nearest station Gunjnoor Cross. The groundwater level during 2011-2017 were slightly varying, where as during the year 2014 was found constant.