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Land Resource and Hydrological Inventory of Bandehalli 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 Bandehalli 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 Bandehalli 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.

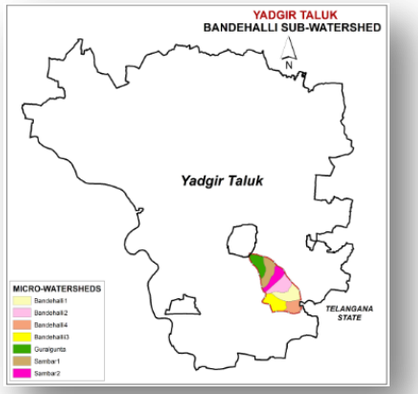
For easy map reading and understanding the information contain in different maps, the physical, cultural and scientific symbols used in the maps are illustrated in the form of colors, graphics and tables.

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.

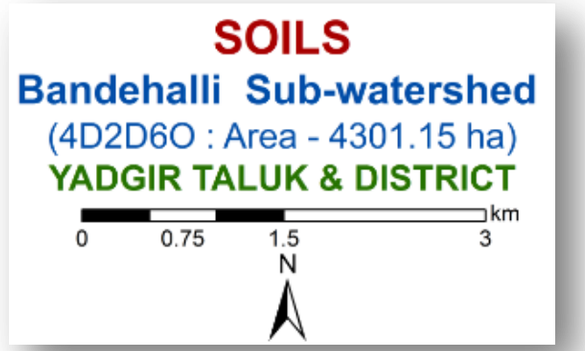
Inset map

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



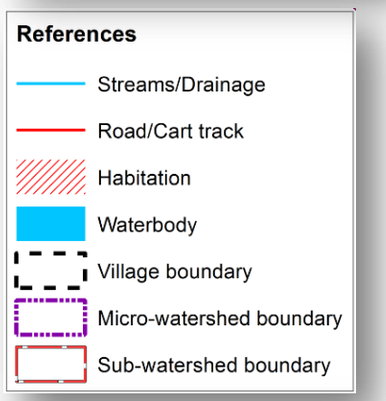
Map title

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



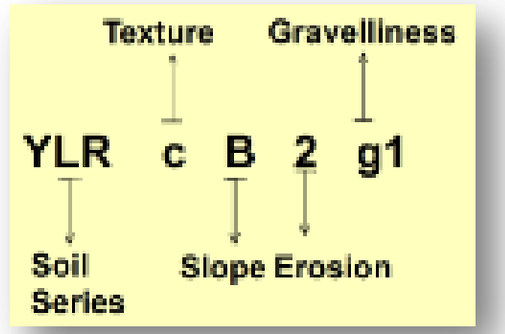
Legends and symbols

*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.*



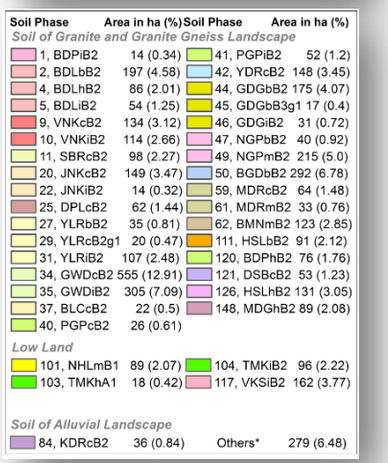
Soil Units

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 Phase	Area in ha (%)	Soil Phase	Area in ha (%)
Soil of Granite and Granite Gneiss Landscape			
1, BDPiB2	14 (0.34)	41, PGPiB2	52 (1.2)
2, BDLbB2	197 (4.58)	42, YDRcB2	148 (3.45)
4, BDLhB2	86 (2.01)	44, GDGbB2	175 (4.07)
5, BDLiB2	54 (1.25)	45, GDGbB3g1	17 (0.4)
9, VNKcB2	134 (3.12)	46, GDGiB2	31 (0.72)
10, VNKiB2	114 (2.66)	47, NGPbB2	40 (0.92)
11, SBRcB2	98 (2.27)	49, NGPmB2	215 (5.0)
20, JNKcB2	149 (3.47)	50, BGDbB2	292 (6.78)
22, JNKiB2	14 (0.32)	59, MDRcB2	64 (1.48)
25, DPLcB2	62 (1.44)	61, MDRmB2	33 (0.76)
27, YLRbB2	35 (0.81)	62, BMNmB2	123 (2.85)
29, YLRcB2g1	20 (0.47)	111, HSLbB2	91 (2.12)
31, YLRiB2	107 (2.48)	120, BDPhB2	76 (1.76)
34, GWDcB2	555 (12.91)	121, DSBcB2	53 (1.23)
35, GWDiB2	305 (7.09)	126, HSLhB2	131 (3.05)
37, BLCcB2	22 (0.5)	148, MDGhB2	89 (2.08)
40, PGPcB2	26 (0.61)		
Low Land			
101, NHLmB1	89 (2.07)	104, TMKiB2	96 (2.22)
103, TMKhA1	18 (0.42)	117, VKSiB2	162 (3.77)
Soil of Alluvial Landscape			
84, KDRcB2	36 (0.84)	Others*	279 (6.48)

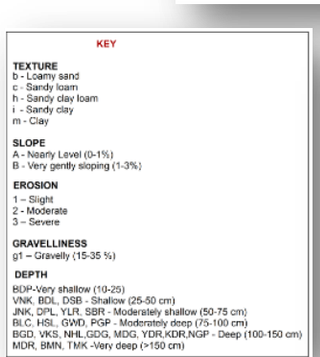
Land Management Units (LMU)

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

LMU	Area in ha (%)
LMU-1	222 (5.16)
LMU-2	891 (20.72)
LMU-3	89 (2.07)
LMU-4	1284 (29.86)
LMU-5	323 (7.51)
LMU-6	224 (5.21)
LMU-7	163 (3.79)
LMU-8	98 (2.27)
LMU-9	728 (16.93)
Others*	279 (6.48)

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.

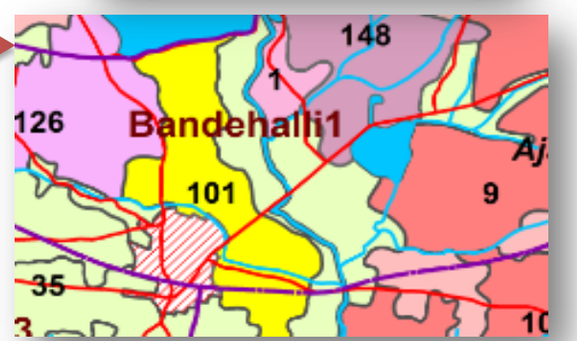


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

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.



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 Bandehalli Sub-watershed covering an area of 4301.15 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.

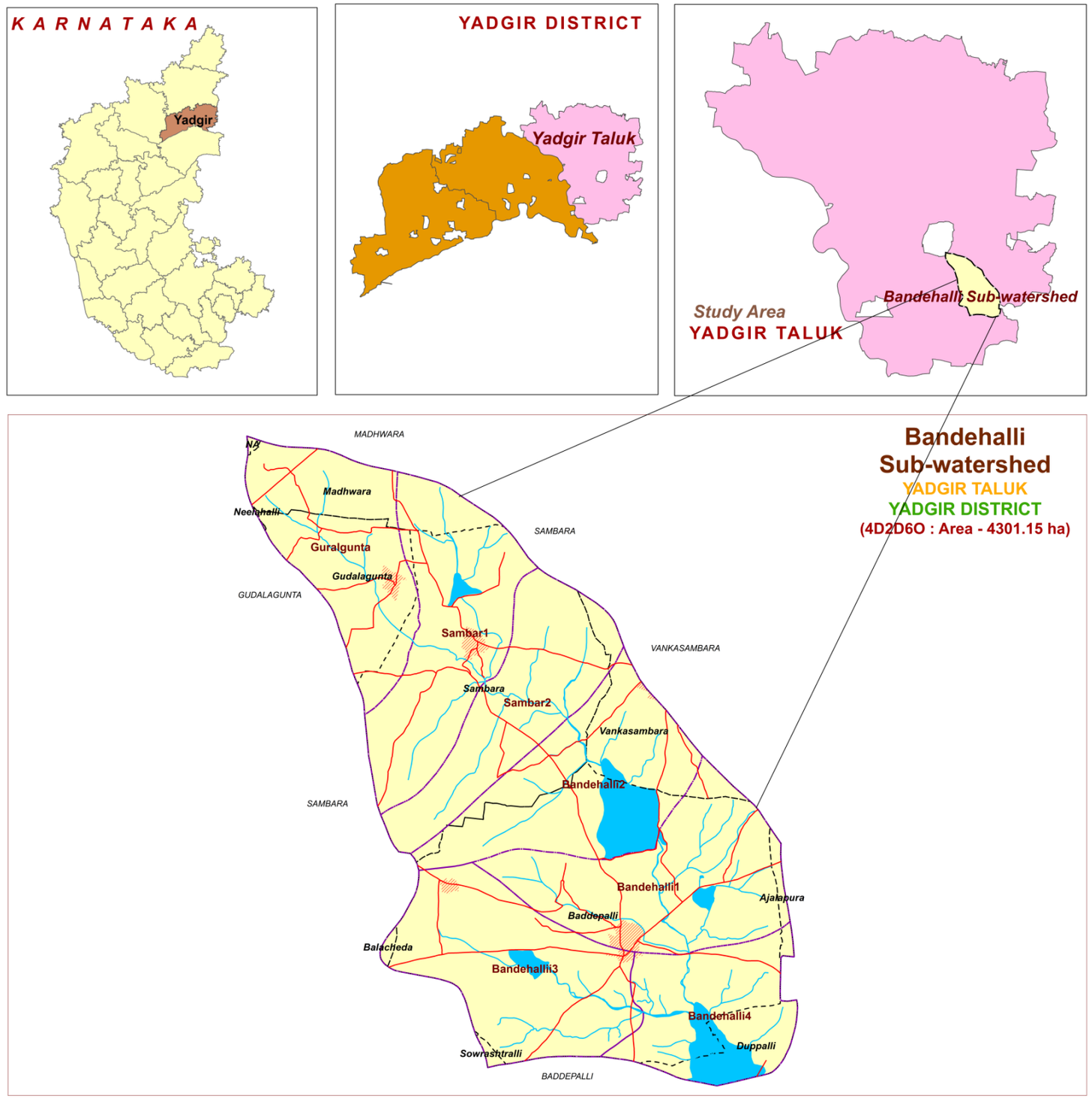
2. General Description of Sub-watershed

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 SWs-LRI for the Bandehalli Sub-watershed in Yadgir taluk, Yadgir district. It was selected for data base generation under Sujala III project. Bandehalli Sub-watershed (code– 4D2D6O) is covering an area of 4301.15 ha and spread across Baddepalli, Madhwara, Gudalagunta, Sambara and Vankasambara villages.

2.1. Location and Extent

LOCATION MAP OF BANDEHALLI SUB-WATERSHED

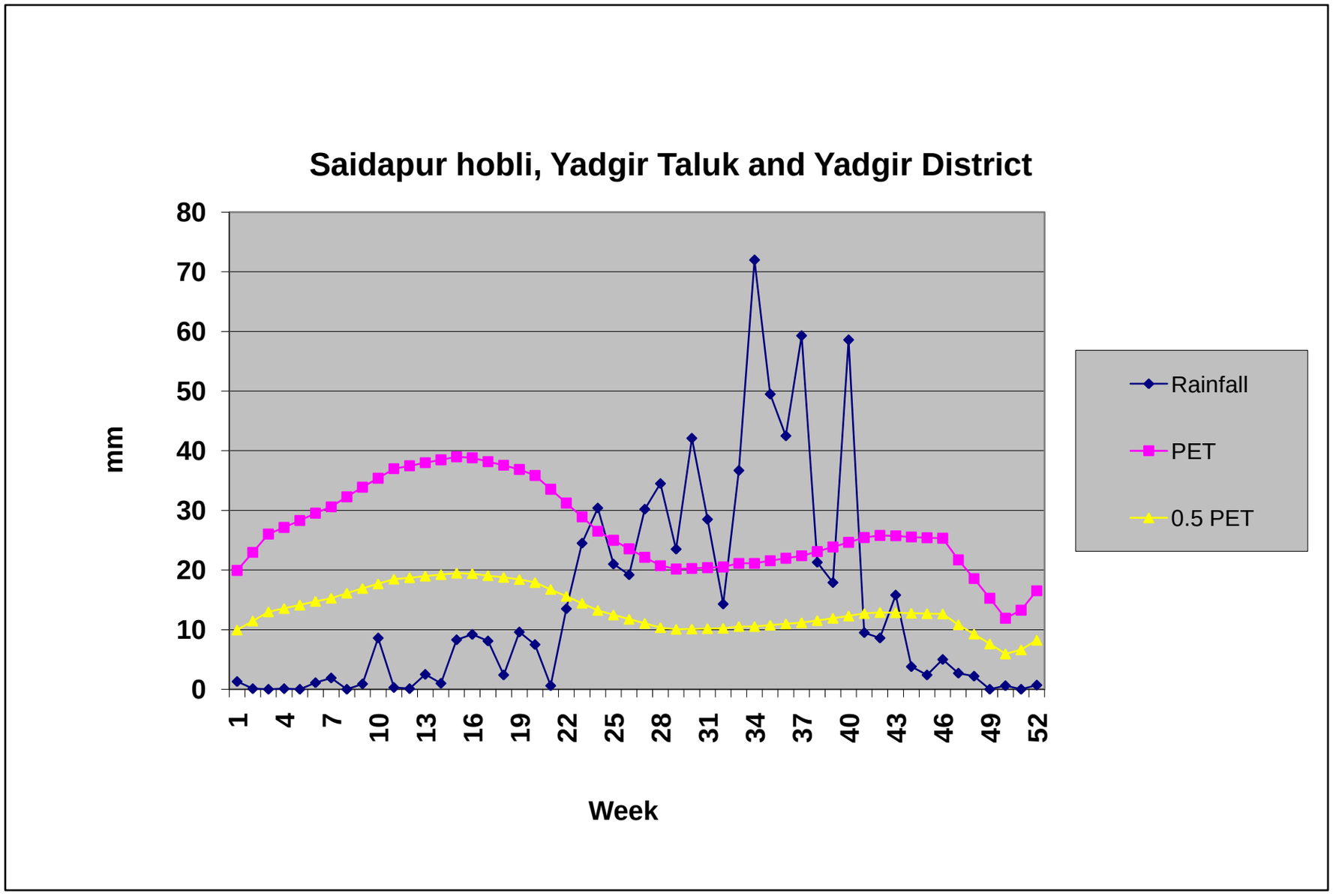


The Bandehalli Sub-watershed (Yadgir taluk, Yadgir district) is located in between $16^0$33' – $16^0$38' North latitudes and $77^0$19' – $77^0$23' East longitudes, covering an area of about 4301.15 ha, bounded by Baddepalli, Madhwara, Gudalagunta, Sambara and Vankasambara villages.

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

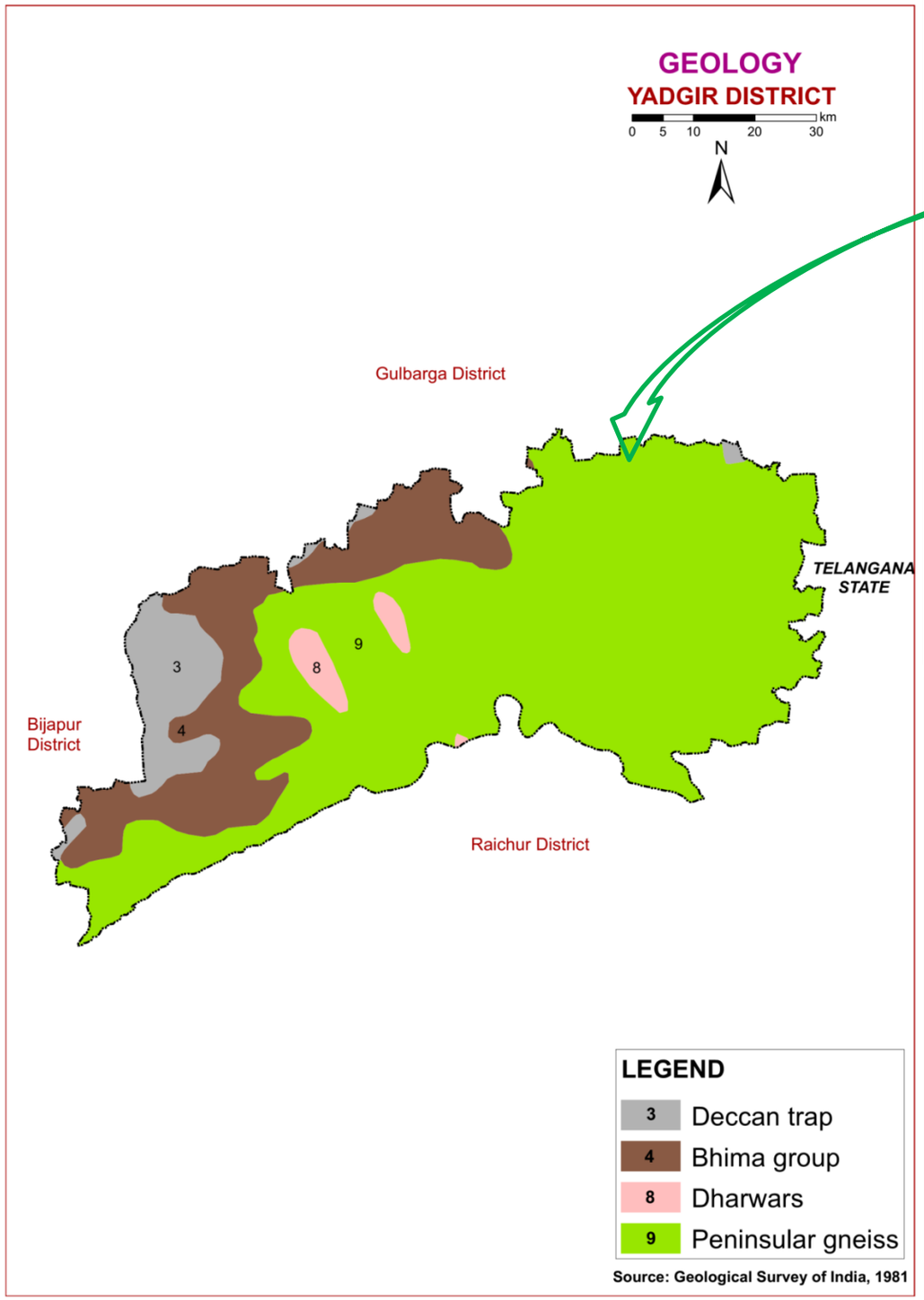


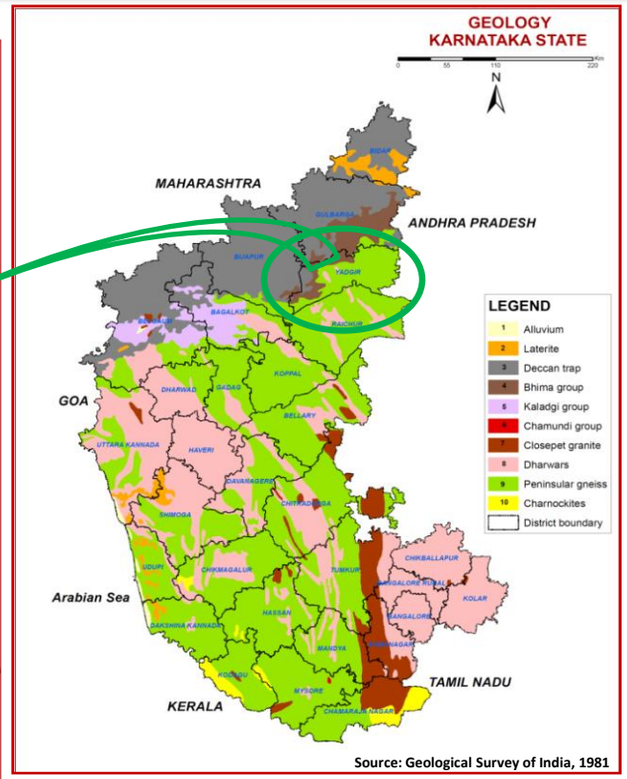
Length of Growing Period (LGP) is varying from June 1st week to 4th week of October (120 - 150 days)

Annual Rainfall : 754mm. in the Saidapur Hobli, Yadgir Taluk & District

Source: KSNDMC (1980-2011)

2.3. 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 - 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.

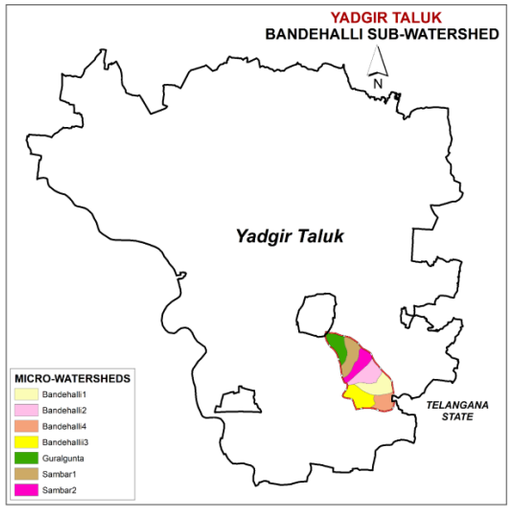
3. Survey Methodology

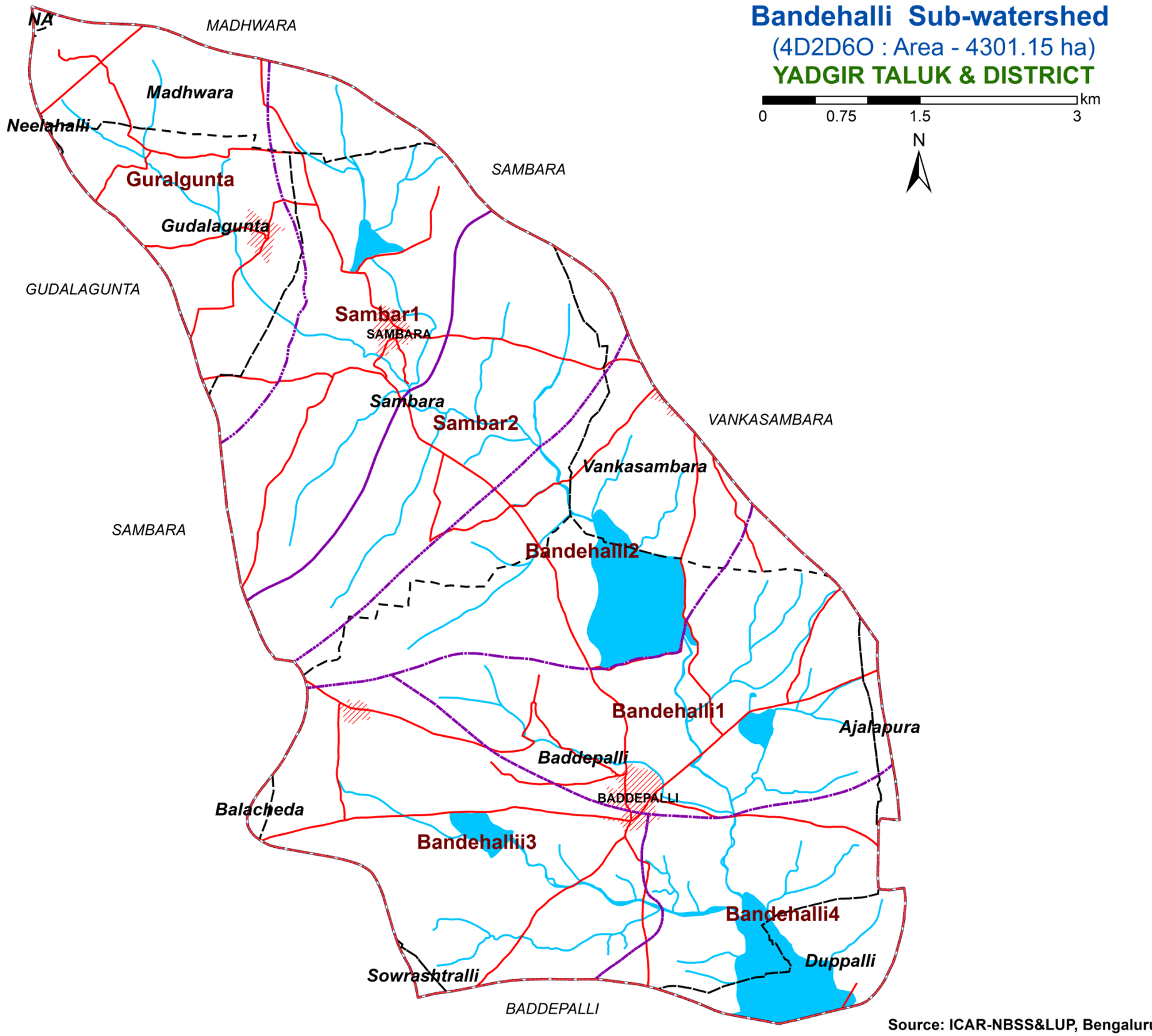
Sequence of activities in generation of LRI

- 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

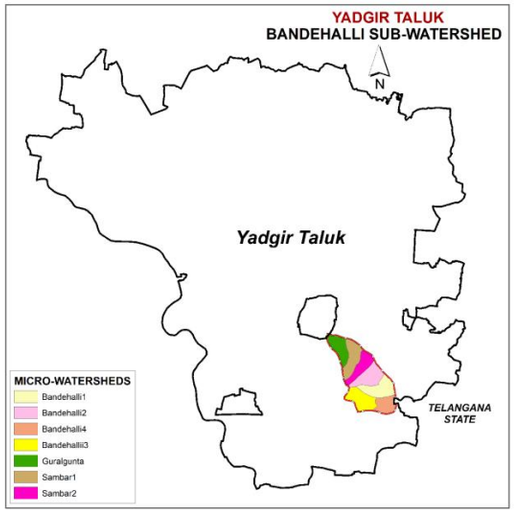
The required site and soil characteristics are described and recorded on a standard proforma by following the protocols and guidelines given in the soil survey manual and field guide. Collection of soil samples from representative pedons for laboratory characterization and collection of surface soil 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.

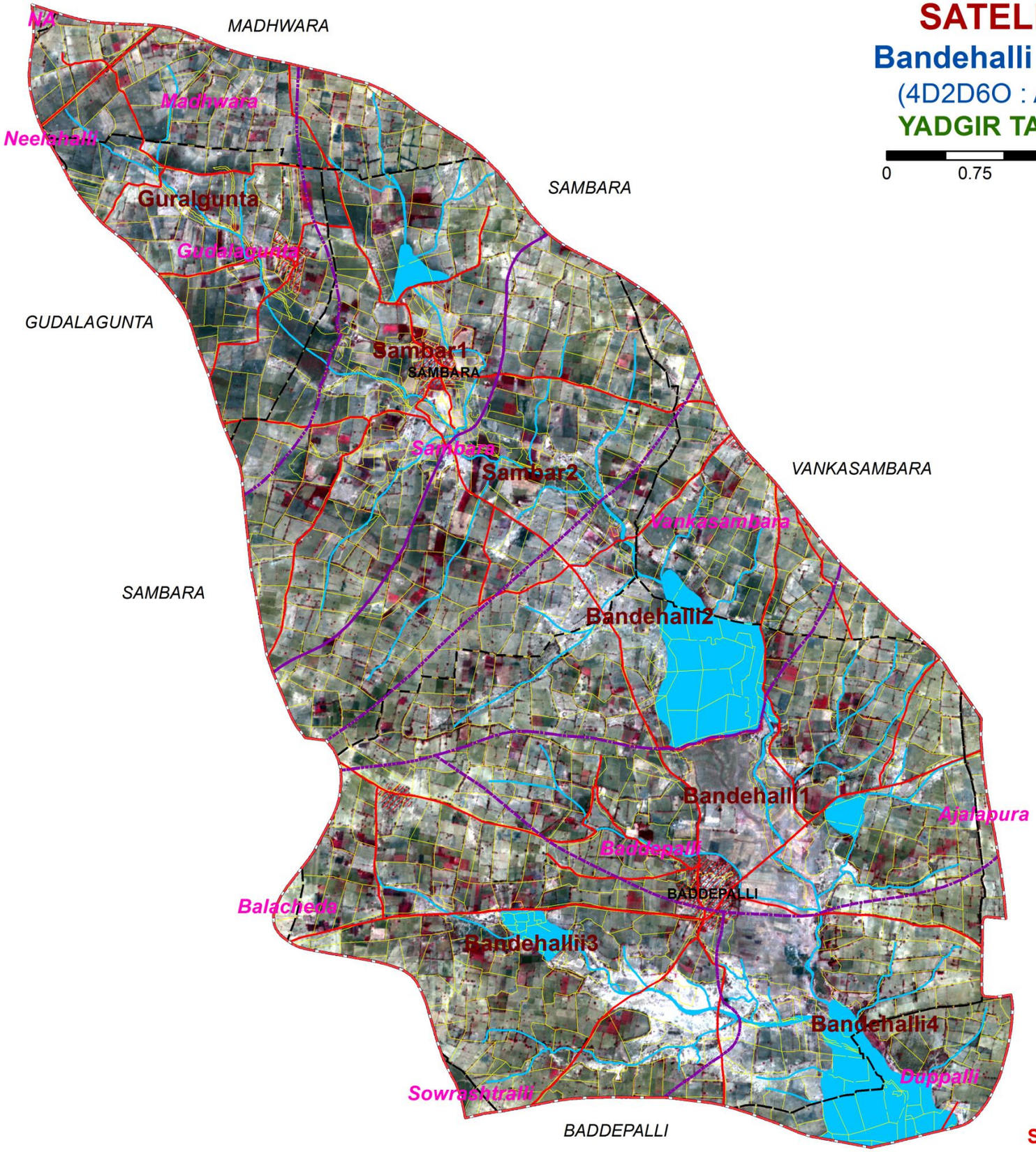
3.1. Database Used - Cadastral map





3.2. Database Used - Satellite Image





SATELLITE IMAGE

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

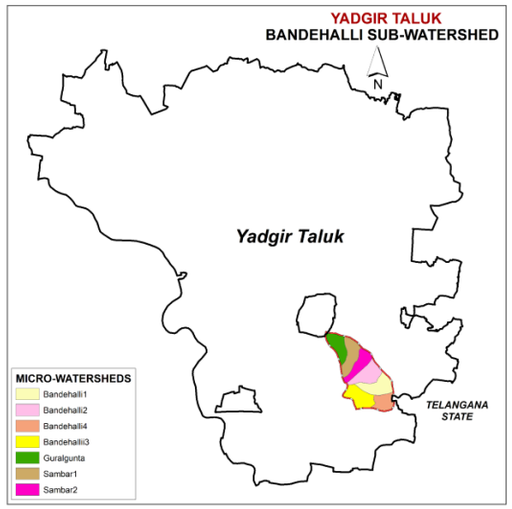
N

References

- Streams/Drainage
- Road/Cart track
- Land parcel
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: Cartosat 1 Imagery

3.3. Current Landuse



CURRENT LANDUSE (2018)

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

N

Current LandUse

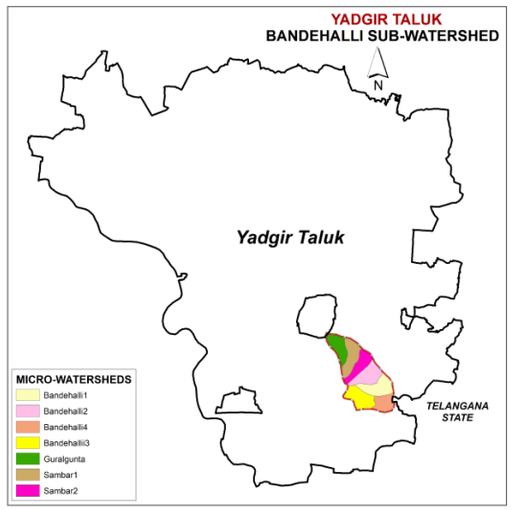
- Cotton (Ct)
- Fallow land (Fl)
- Greengram (Gg)
- Groundnut (Gn)
- Jowar (Jw)
- Paddy (Pd)
- Ragi (Ra)
- Redgram (Rg)
- Cotton+Fallow land (Ct+Fl)
- Cotton+Greengram (Ct+Gg)
- Cotton+Groundnut (Ct+Gn)
- Cotton+Jowar (Ct+Jw)
- Cotton+Paddy (Ct+Pd)
- Cotton+Redgram (Ct+Rg)
- Cotton+Scrub land (Ct+Sl)
- Fallow land+Groundnut (Fl+Gn)
- Fallow land+Paddy (Fl+Pd)
- Fallow land+Redgram (Fl+Rg)
- Fallow land+Scrub land (Fl+Sl)
- Greengram+Paddy (Gg+Pd)
- Greengram+Redgram (Gg+Rg)
- Groundnut+Jowar (Gn+Jw)
- Groundnut+Paddy (Gn+Pd)
- Groundnut+Redgram (Gn+Rg)
- Jowar+Paddy (Jw+Pd)
- Jowar+Redgram (Jw+Rg)
- No crop+Scrub land (Nc+Sl)
- Paddy+Cotton (Pd+Ct)
- Paddy+Redgram (Pd+Rg)
- Paddy+Scrub land (Pd+Sl)
- Ragi+Cotton (Ra+Ct)
- Ragi+Paddy (Ra+Pd)
- Redgram+Cotton (Rg+Ct)
- Redgram+Fallow land (Rg+Fl)
- Redgram+Groundnut (Rg+Gn)
- Redgram+Jowar (Rg+Jw)
- Redgram+Paddy (Rg+Pd)
- Redgram+Scrub land (Rg+Sl)
- Redgram+Sugarcane (Rg+Sc)
- Cotton+Fallow land+Paddy (Ct+Fl+Pd)
- Cotton+Greengram+Paddy (Ct+Gg+Pd)
- Cotton+Greengram+Redgram (Ct+Gg+Rg)
- Cotton+Groundnut+Paddy (Ct+Gn+Pd)
- Cotton+Groundnut+Redgram (Ct+Gn+Rg)
- Cotton+Jowar+Redgram (Ct+Jw+Rg)
- Cotton+Marigold+Paddy (Ct+Mg+Pd)
- Cotton+Paddy+Ragi (Ct+Pd+Ra)
- Cotton+Paddy+Redgram (Ct+Pd+Rg)
- Cotton+Paddy+Scrub land (Ct+Pd+Sl)
- Cotton+Redgram+Scrub land (Ct+Rg+Sl)
- Cotton+Redgram+Sorghum (Ct+Rg+Sg)
- Fallow land+Paddy+Scrub land (Fl+Pd+Sl)
- Greengram+Paddy+Redgram (Gg+Pd+Rg)
- Groundnut+Paddy+Redgram (Gn+Pd+Rg)
- Jowar+Cotton+Redgram (Jw+Ct+Rg)
- Jowar+Paddy+Cotton (Jw+Pd+Ct)
- Jowar+Ragi+Cotton (Jw+Ra+Ct)
- Onion+Paddy+Redgram (On+Pd+Rg)
- Ragi+Cotton+Paddy (Ra+Ct+Pd)
- Redgram+Cotton+Fallow land (Rg+Ct+Fl)
- Redgram+Cotton+Jowar (Rg+Ct+Jw)
- Redgram+Groundnut+Cotton (Rg+Gn+Ct)
- Redgram+Groundnut+Paddy (Rg+Gn+Pd)
- Redgram+Jowar+Groundnut (Rg+Jw+Gn)
- Redgram+Paddy+Cotton (Rg+Pd+Ct)
- Cotton+Groundnut+Marigold+Paddy (Ct+Gn+Mg+Pd)
- Redgram+Groundnut+Fallow land+Paddy (Rg+Gn+Fl+Pd)
- Redgram+Groundnut+Paddy+Cotton (Rg+Gn+Pd+Ct)
- Scrub land (Sl)
- Scrub land+Cotton (Sl+Ct)
- Scrub land+Redgram (Sl+Rg)
- Scrub land+Waterbody (Sl+Wb)
- Scrubland+Paddy (Sl+Pd)
- Scrubland+Redgram (Sl+Rg)
- Scrub land+Redgram+Cotton (Sl+Rg+Ct)
- Scrub land+Redgram+Waterbody (Sl+Rg+Wb)
- Road
- Habitation
- Waterbody
- Not Available (NA)

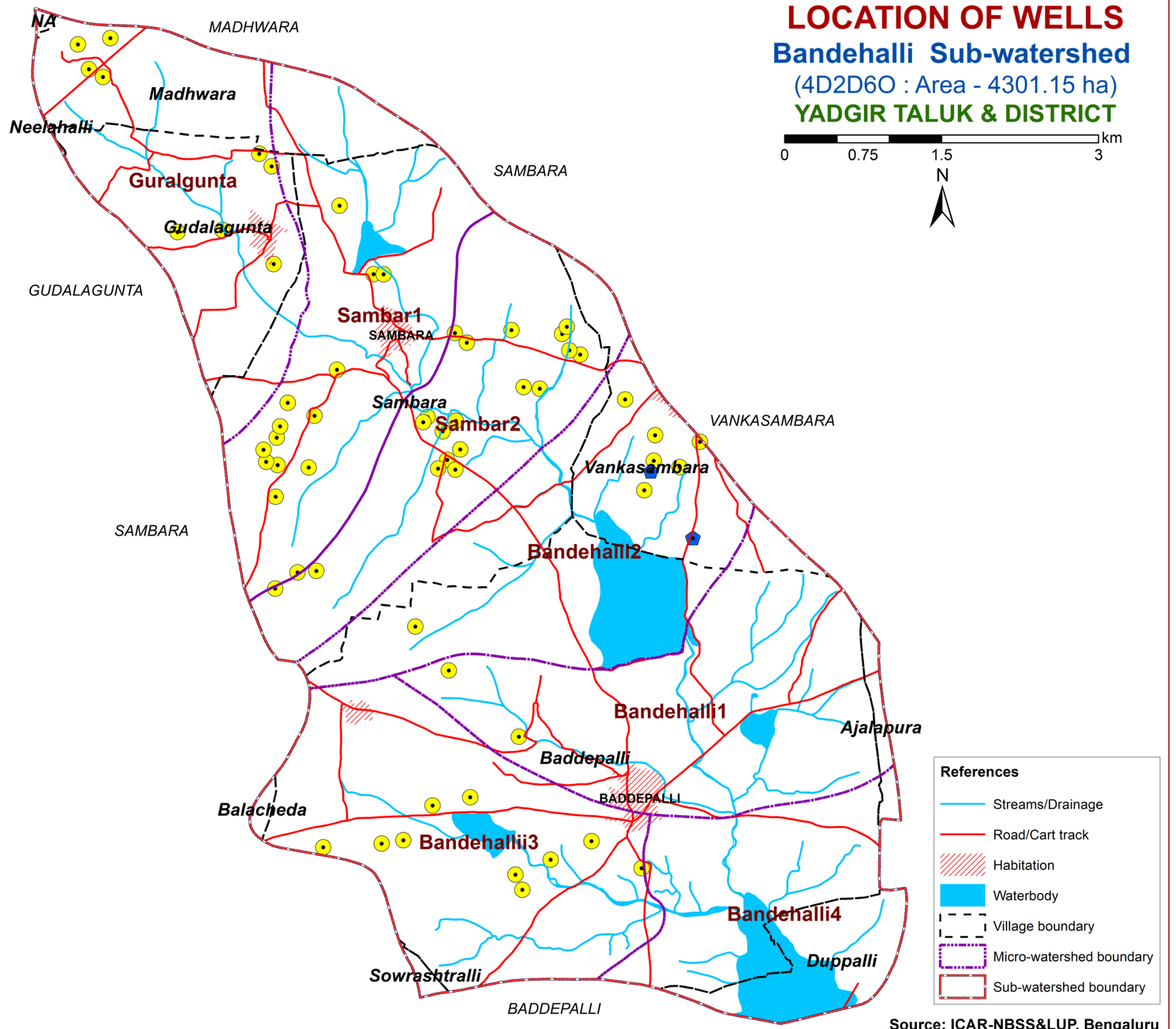
References

- Streams/Drainage
- Road/Cart track
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

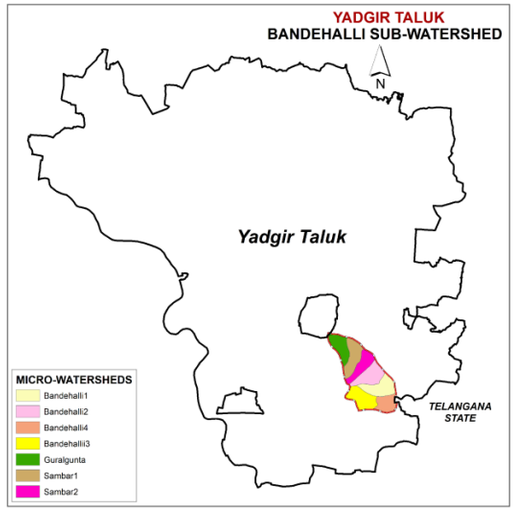
3.4. Location of Wells

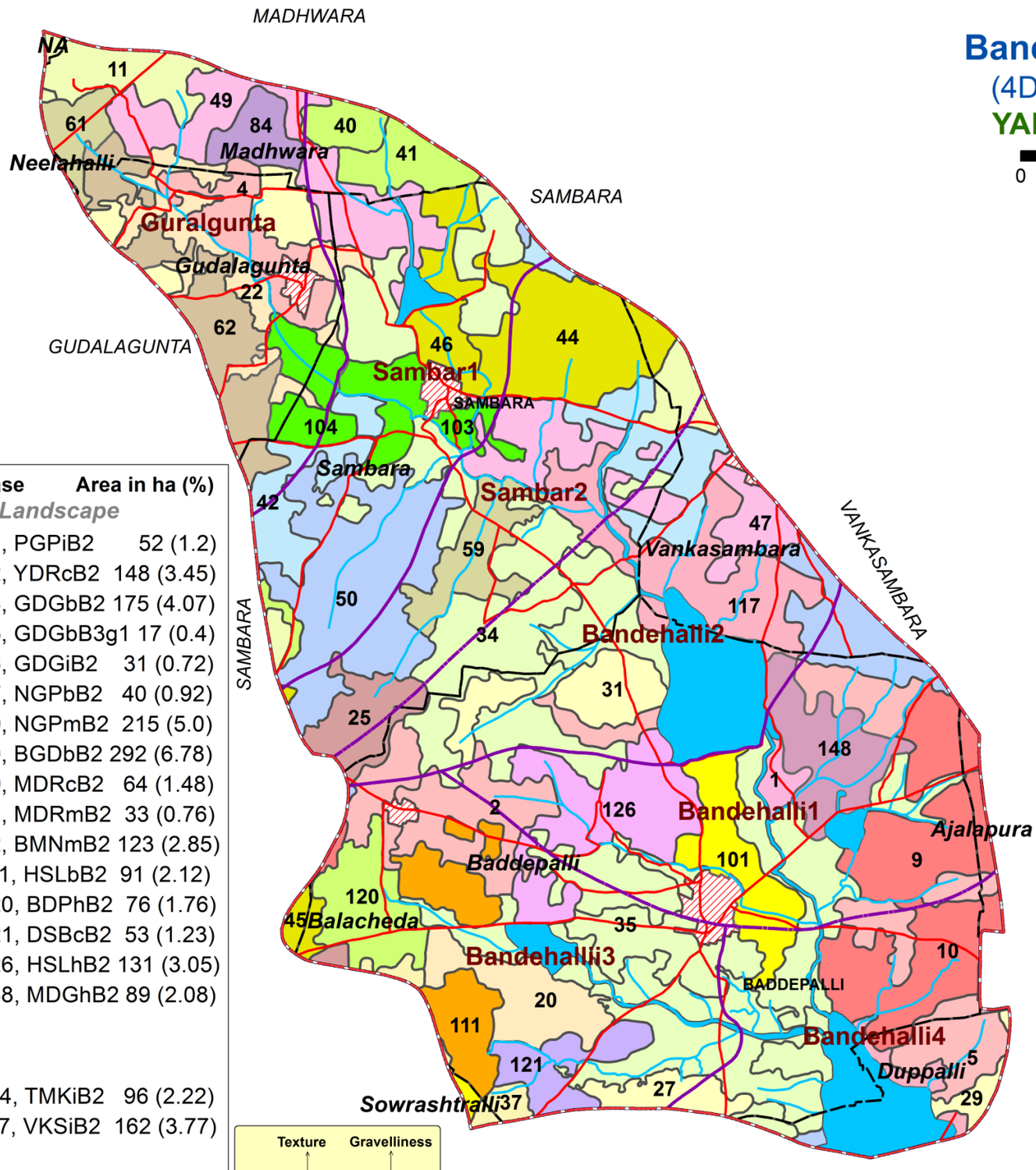




Legend	No's
Bore well	61
Open well	2

4. The Soils





SOILS

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

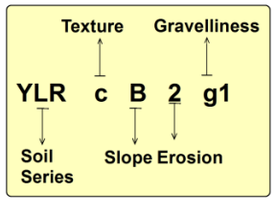
YADGIR TALUK & DISTRICT

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			
1, BDPiB2	14 (0.34)	41, PGPiB2	52 (1.2)
2, BDLbB2	197 (4.58)	42, YDRcB2	148 (3.45)
4, BDLhB2	86 (2.01)	44, GDGbB2	175 (4.07)
5, BDLiB2	54 (1.25)	45, GDGbB3g1	17 (0.4)
9, VNKcB2	134 (3.12)	46, GDGiB2	31 (0.72)
10, VNKiB2	114 (2.66)	47, NGPbB2	40 (0.92)
11, SBRcB2	98 (2.27)	49, NGPmB2	215 (5.0)
20, JNKcB2	149 (3.47)	50, BGDbB2	292 (6.78)
22, JNKiB2	14 (0.32)	59, MDRcB2	64 (1.48)
25, DPLcB2	62 (1.44)	61, MDRmB2	33 (0.76)
27, YLRbB2	35 (0.81)	62, BMNmB2	123 (2.85)
29, YLRcB2g1	20 (0.47)	111, HSLbB2	91 (2.12)
31, YLRiB2	107 (2.48)	120, BDPhB2	76 (1.76)
34, GWDcB2	555 (12.91)	121, DSBcB2	53 (1.23)
35, GWDiB2	305 (7.09)	126, HSLhB2	131 (3.05)
37, BLCcB2	22 (0.5)	148, MDGhB2	89 (2.08)
40, PGPcB2	26 (0.61)		
Low Land			
101, NHLmB1	89 (2.07)	104, TMKiB2	96 (2.22)
103, TMKhA1	18 (0.42)	117, VKSiB2	162 (3.77)
Soil of Alluvial Landscape			
84, KDRcB2	36 (0.84)	Others*	279 (6.48)

* - Habitation & Waterbody



KEY

TEXTURE
b - Loamy sand
c - Sandy loam
h - Sandy clay loam
i - Sandy clay
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 %)

DEPTH
BDP-Very shallow (10-25)
VNK, BDL, DSB - Shallow (25-50 cm)
JNK, DPL, YLR, SBR - Moderately shallow (50-75 cm)
BLC, HSL, GWD, PGP - Moderately deep (75-100 cm)
BGD, VKS, NHL,GDG, MDG, YDR,KDR,NGP - Deep (100-150 cm)
MDR, BMN, TMK -Very deep (>150 cm)

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

4.1 Mapping unit description of Bandehalli(4D2D6O) 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				
	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		**97 (2.24)**
59		MDRcB2	Sandy loam surface, slope 1-3%, moderate erosion	64 (1.48)
61		MDRmB2	Clay surface, slope 1-3%, moderate erosion	33 (0.76)
	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		**123 (2.85)**
62		BMNmB2	Clay surface, slope 1-3%, moderate erosion	123 (2.85)
	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		**89 (2.08)**
148		MDGhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	89 (2.08)
	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		**255 (5.92)**
47		NGPbB2	Loamy sand surface, slope 1-3%, moderate erosion	40 (0.92)
49		NGPmB2	Clay surface, slope 1-3%, moderate erosion	215 (5.0)
	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		**292 (6.78)**
50		BGDbB2	Loamy sand surface, slope 1-3%, moderate erosion	292 (6.78)
	YDR	Yadgir soils are deep (100-150 cm), well drained, have brown to dark yellowish brown and olive brown, sodic sandy loam soils occurring on very gently sloping uplands under cultivation		**148 (3.45)**
42		YDRcB2	Sandy loam surface, slope 1-3%, moderate erosion	148 (3.45)
	GDG	Gondedagi soils are deep (100-150 cm), well drained, have dark reddish gray to dark brown, sandy clay loam soils occurring on very gently to gently sloping uplands under cultivation		**223 (5.19)**
44		GDGbB2	Loamy sand surface, slope 1-3%, moderate erosion	175 (4.07)
45		GDGbB3g1	Loamy sand surface, slope 1-3%, severe erosion, gravelly (15-35%)	17 (0.4)
46		GDGiB2	Sandy clay surface, slope 1-3%, moderate erosion	31 (0.72)

To be continued....

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
	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		**222 (5.17)**
111		HSLbB2	Loamy sand surface, slope 1-3%, moderate erosion	91 (2.12)
126		HSLhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	131 (3.05)
	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		**860 (20)**
34		GWDcB2	Sandy loam surface, slope 1-3%, moderate erosion	555 (12.91)
35		GWDiB2	Sandy clay surface, slope 1-3%, moderate erosion	305 (7.09)
	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		**22 (0.5)**
37		BLCcB2	Sandy loam surface, slope 1-3%, moderate erosion	22 (0.5)
	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		**78 (1.81)**
40		PGPcB2	Sandy loam surface, slope 1-3%, moderate erosion	26 (0.61)
41		PGPiB2	Sandy clay surface, slope 1-3%, moderate erosion	52 (1.2)
	DPL	Duppali soils are moderately shallow (50-75 cm), well drained, have dark brown to dark reddish brown, sandy clay soils occurring on very gently to gently sloping uplands under cultivation		**62 (1.44)**
25		DPLcB2	Sandy loam surface, slope 1-3%, moderate erosion	62 (1.44)
	YLR	Yalleri soils are moderately shallow (50-75 cm), well drained, have brown to reddish brown and dark reddish brown, clay red soils occurring on very gently to gently sloping uplands under cultivation		**162 (3.76)**
27		YLRbB2	Loamy sand surface, slope 1-3%, moderate erosion	35 (0.81)
29		YLRcB2g1	Sandy loam surface, slope 1-3%, moderate erosion, gravelly (15-35%)	20 (0.47)
31		YLRiB2	Sandy clay surface, slope 1-3%, moderate erosion	107 (2.48)
	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		**163 (3.79)**
20		JNKcB2	Sandy loam surface, slope 1-3%, moderate erosion	149 (3.47)
22		JNKiB2	Sandy clay surface, slope 1-3%, moderate erosion	14 (0.32)
	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		**98 (2.27)**
11		SBRcB2	Sandy clay surface, slope 1-3%, moderate erosion	98 (2.27)

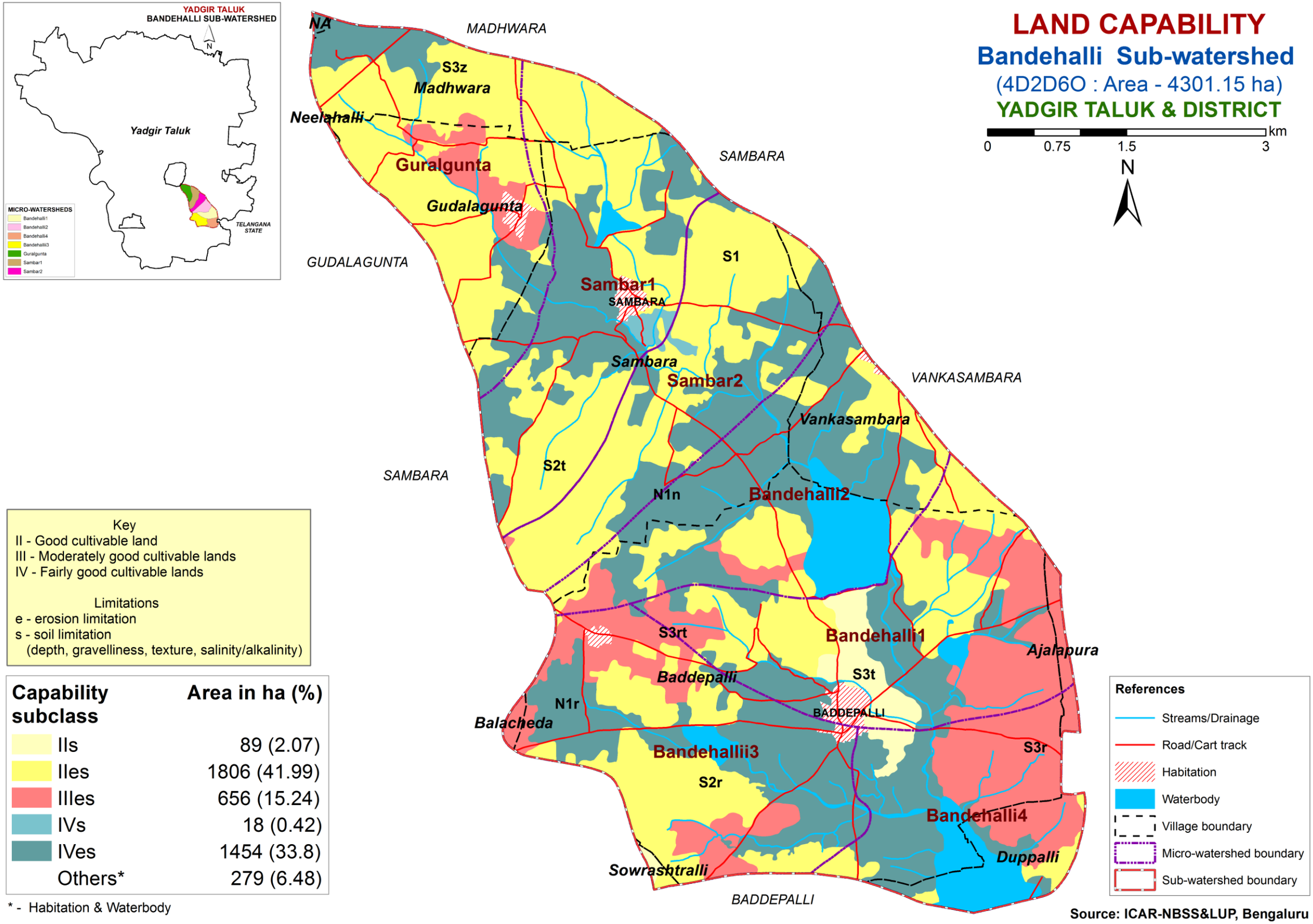
To be continued….

Soil map unit No*	Soil Series	Soil Phase Symbol	Mapping Unit Description	Area in ha (%)
	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		**337 (7.84)**
2		BDLbB2	Loamy sand surface, slope 1-3%, moderate erosion	197 (4.58)
4		BDLhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	86 (2.01)
5		BDLiB2	Sandy clay surface, slope 1-3%, moderate erosion	54 (1.25)
	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		**248 (5.78)**
9		VNKcB2	Sandy loam surface, slope 1-3%, moderate erosion	134 (3.12)
10		VNKiB2	Sandy clay surface, slope 1-3%, moderate erosion	114 (2.66)
	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		**53 (1.23)**
121		DSBcB2	Sandy clay surface, slope 1-3%, moderate erosion	53 (1.23)
	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		**90 (2.1)**
1		BDPiB2	Sandy clay surface, slope 1-3%, moderate erosion	14 (0.34)
120		BDPhB2	Sandy clay loam surface, slope 1-3%, moderate erosion	76 (1.76)
	TMK	Thumakur soils are very deep (>150 cm), moderately well drained, have very dark gray to dark brown, slightly calcareous sodic clay soils occurring on nearly level to very gently sloping low lands under cultivation		**114 (2.64)**
103		TMKhA1	Sandy clay loam surface, slope 0-1%, slight erosion	18 (0.42)
104		TMKiB2	Sandy clay surface, slope 1-3%, moderate erosion	96 (2.22)
	NHL	Neelahalli soils are deep (100-150 cm), well drained, have dark grayish brown to brown sandy loam soils occurring on nearly level to very gently sloping lowlands under cultivation		**89 (2.07)**
101		NHLmB1	Clay surface, slope 1-3%, slight erosion	89 (2.07)
	VKS	Vankasambar soils are deep (100-150 cm), well drained, very dark brown to brown, sodic calcareous sandy clay loam soils occurring on very gently to gently sloping lowlands under cultivation		**162 (3.77)**
117		VKSiB2	Sandy clay surface, slope 1-3%, moderate erosion	162 (3.77)
Soils Alluvial Landscape				
	KDR	Kudlura soils are deep (100-150 cm), moderately well drained, have very dark gray to grayish brown, calcareous cracking clay soils occurring on nearly level to very gently sloping plains under cultivation		**36 (0.84)**
84		KDRcB2	Sandy loam surface, slope 1-3%, moderate erosion	36 (0.84)
1000		Others	Habitation & Waterbody	**279 (6.48)**

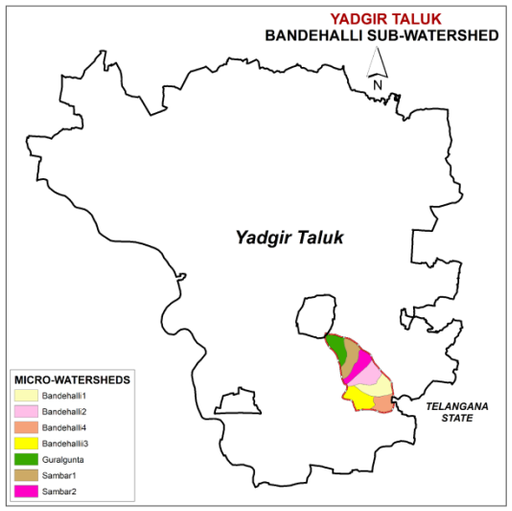
* Soil map unit numbers are continuous for the taluk, not for the sub-watershed

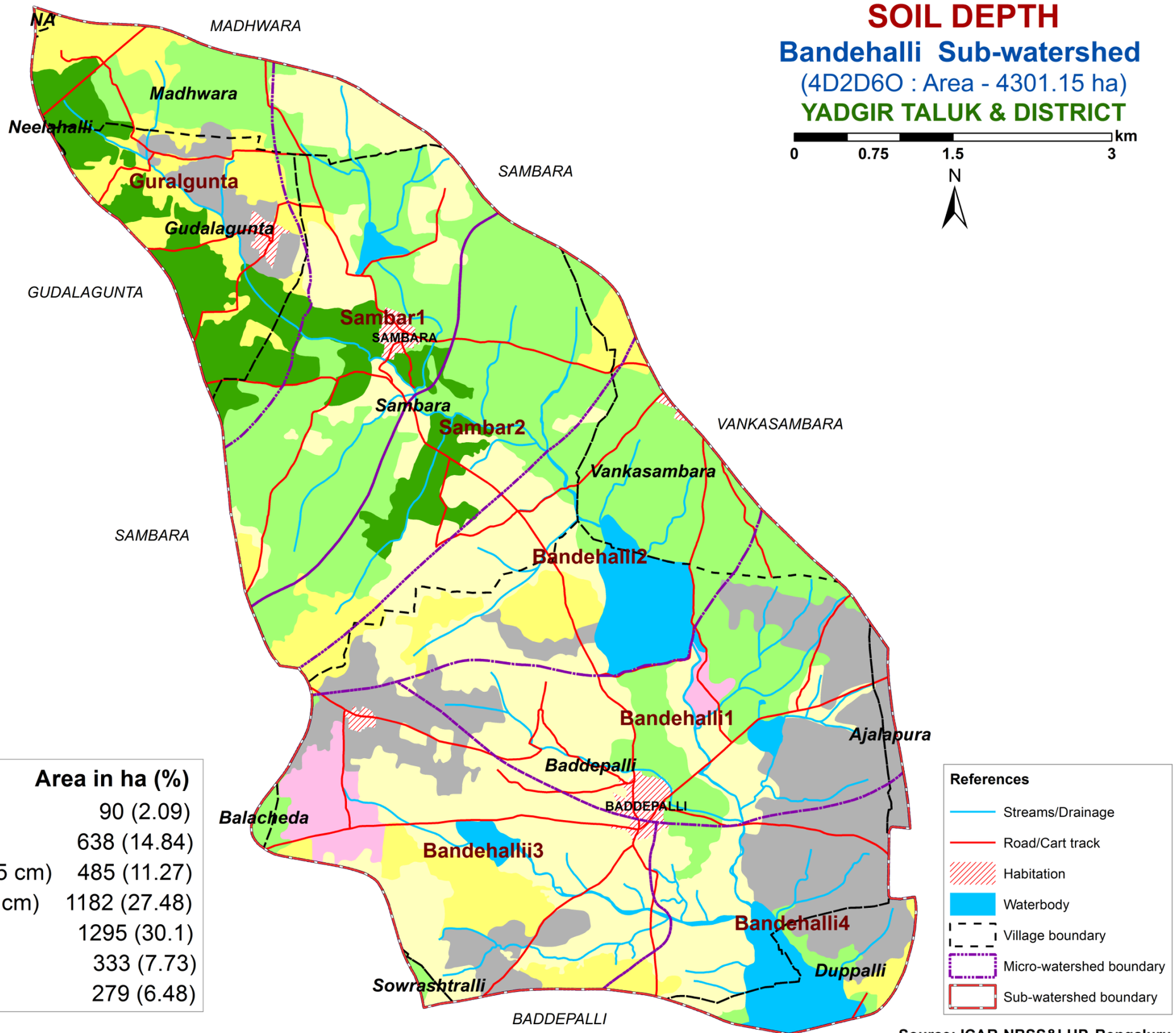
5. Soil Survey Interpretations

5.1. Land Capability Classification



5.2. Soil Depth



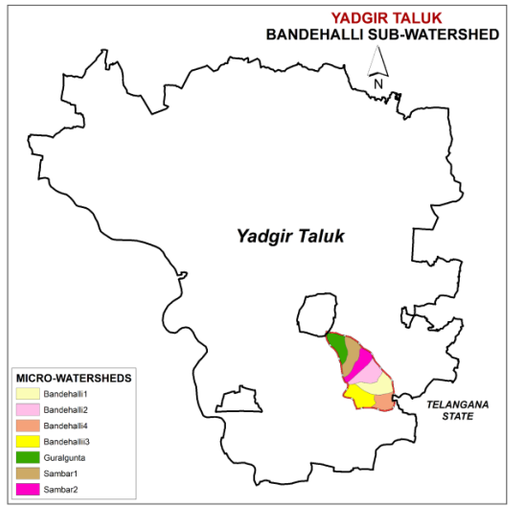


Depth Class	Area in ha (%)
Very shallow (<25 cm)	90 (2.09)
Shallow (25-50 cm)	638 (14.84)
Moderately shallow (50-75 cm)	485 (11.27)
Moderately deep (75-100 cm)	1182 (27.48)
Deep (100-150 cm)	1295 (30.1)
Very deep (>150 cm)	333 (7.73)
Others*	279 (6.48)

* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

5.3. Surface Soil Texture



SURFACE SOIL TEXTURE

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

N

NA
MADHWARA
Madhwara
Neelahalli
Guralgunta
Gudalagunta
SAMBARA
GUDALAGUNTA
Sambar1
SAMBARA
Sambara
Sambar2
VANKASAMBARA
Vankasambara
SAMBARA
Bandehalli2
Bandehalli1
Ajalapura
Baddepalli
BADDEPALLI
Balacheda
Bandehallii3
Bandehalli4
Duppalli
Sowrashtralli
BADDEPALLI

Texture Class	Area in ha(%)
Loamy sand	847 (19.68)
Sandy loam	1368 (31.8)
Sandy clay loam	400 (9.3)
Sandy clay	948 (22.05)
Clay	460 (10.68)
Others*	279 (6.48)

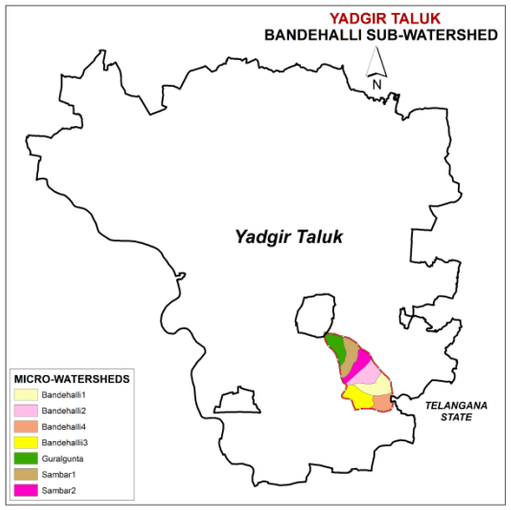
* - Habitation & Waterbody

References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.4. Surface Soil Gravelliness



SOIL GRAVELLINESS

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

N

NA
MADHWARA
Madhwara
Neelahalli
Guralgunta
Gudalagunta
GUDALAGUNTA
SAMBARA
SAMBARA
Sambar1
SAMBARA
Sambara
Sambar2
VANKASAMBARA
Vankasambara
SAMBARA
Bandehalli2
Bandehalli1
Ajalapura
Baddepalli
BADDEPALLI
Balacheda
Bandehallii3
Bandehalli4
Duppalli
Sowrashtralli
BADDEPALLI

Gravelly Class	Area in ha (%)
Non gravelly (<15%)	3985 (92.65)
Gravelly (15-35%)	38 (0.87)
Others*	279 (6.48)

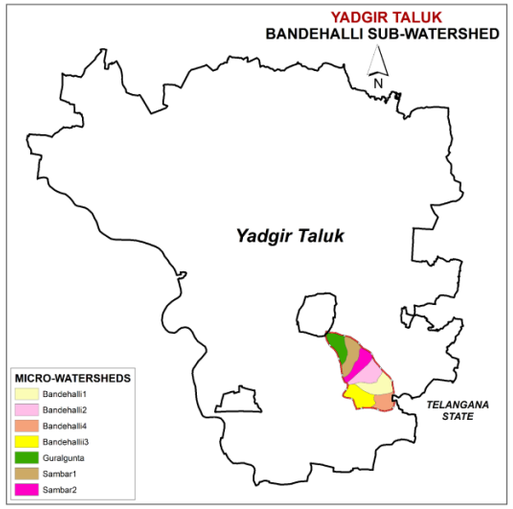
* - Habitation & Waterbody

References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.5. Available Water Capacity



AVAILABLE WATER CAPACITY

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.5 1 2 km

N

MADHWARA
SAMBARA
GUDALAGUNTA
SAMBARA
VANKASAMBARA
BADDEPALLI

NA
Madhwara
Neelahalli
Guralgunta
Gudalagunta
Sambar1
SAMBARA
Sambara
Sambar2
Vankasambara
Bandehalli2
Bandehalli1
Ajalapura
Baddepalli
BADDEPALLI
Balacheda
Bandehallii3
Bandehalli4
Duppalli
Sowrashtralli

Available Water Capacity	Area in ha (%)
Very low (<50 mm/m)	826 (19.21)
Low (51-100 mm/m)	635 (14.77)
Medium (101-150 mm/m)	1306 (30.36)
Very high (>200 mm/m)	1256 (29.19)
Others*	279 (6.48)

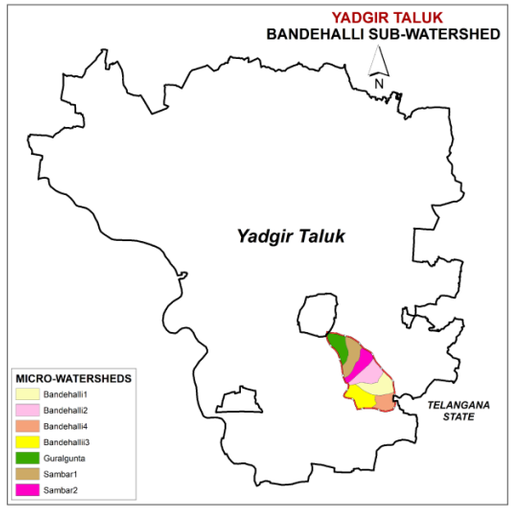
* - Habitation & Waterbody

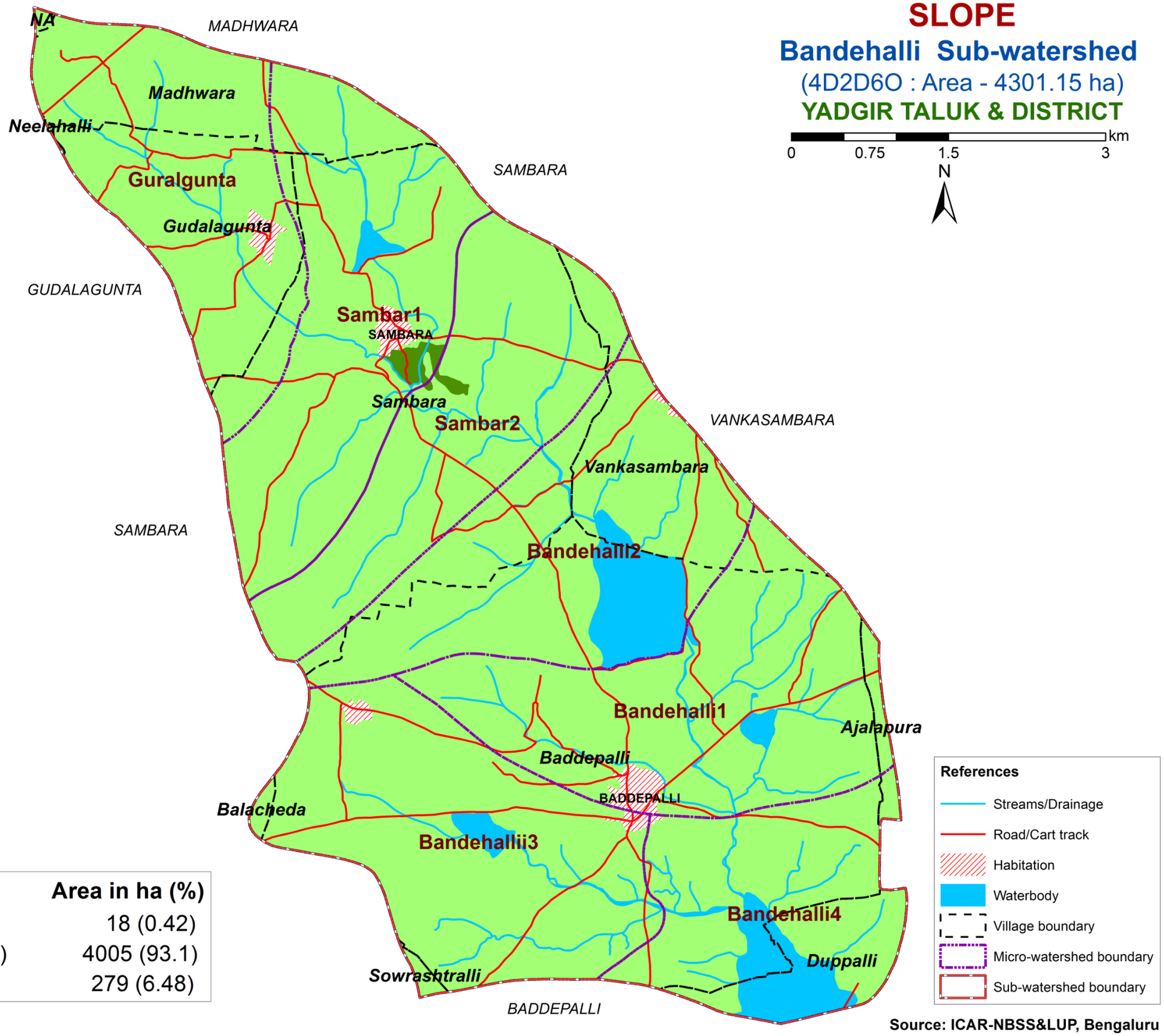
References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

5.6.Slope

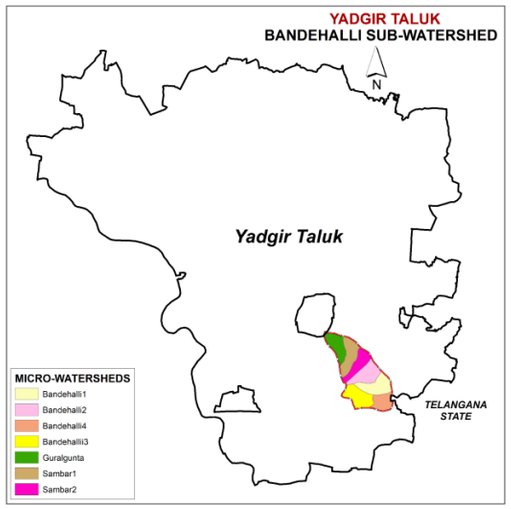


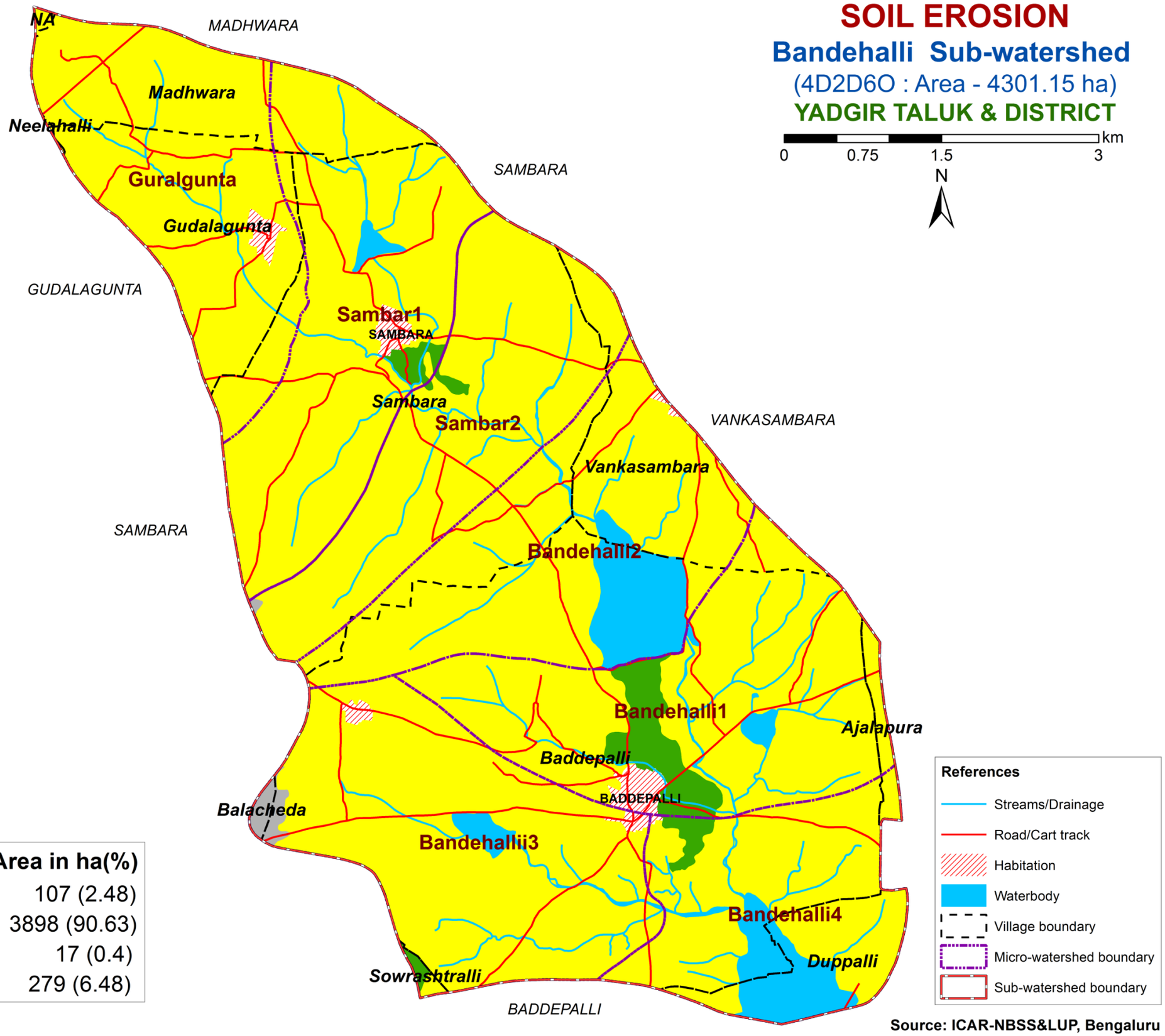


Slope Class	Area in ha (%)
Nearly level (0-1%)	18 (0.42)
Very gently sloping (1-3%)	4005 (93.1)
Others*	279 (6.48)

* - Habitation & Waterbody

5.7.Soil Erosion



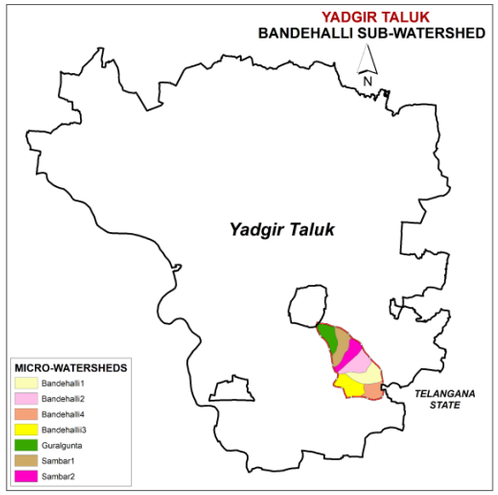


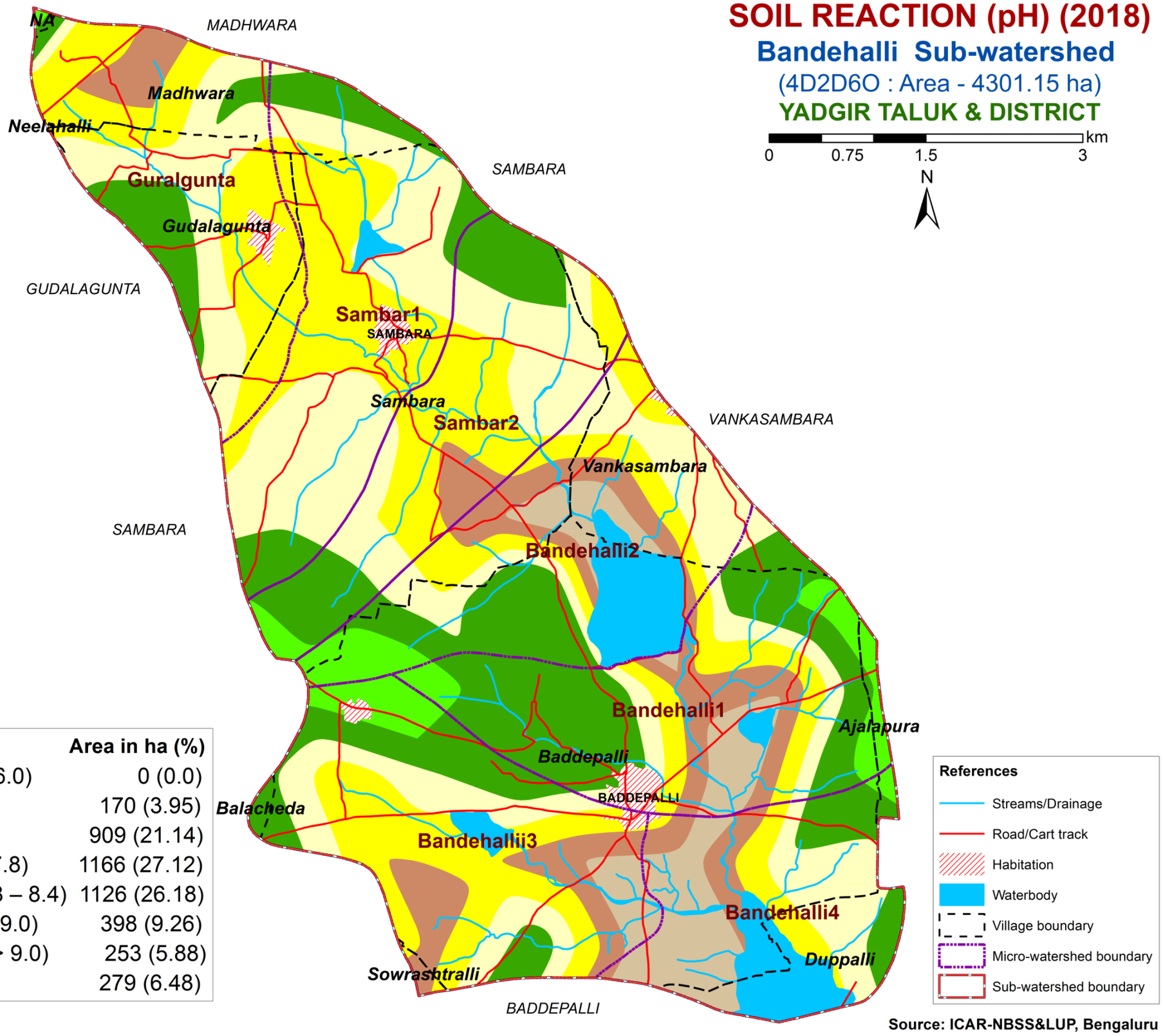
Erosion Class	Area in ha(%)
Slight	107 (2.48)
Moderate	3898 (90.63)
Severe	17 (0.4)
Others*	279 (6.48)

* - Habitation & Waterbody

6. Soil Fertility Status

6.1. Soil Reaction (pH)



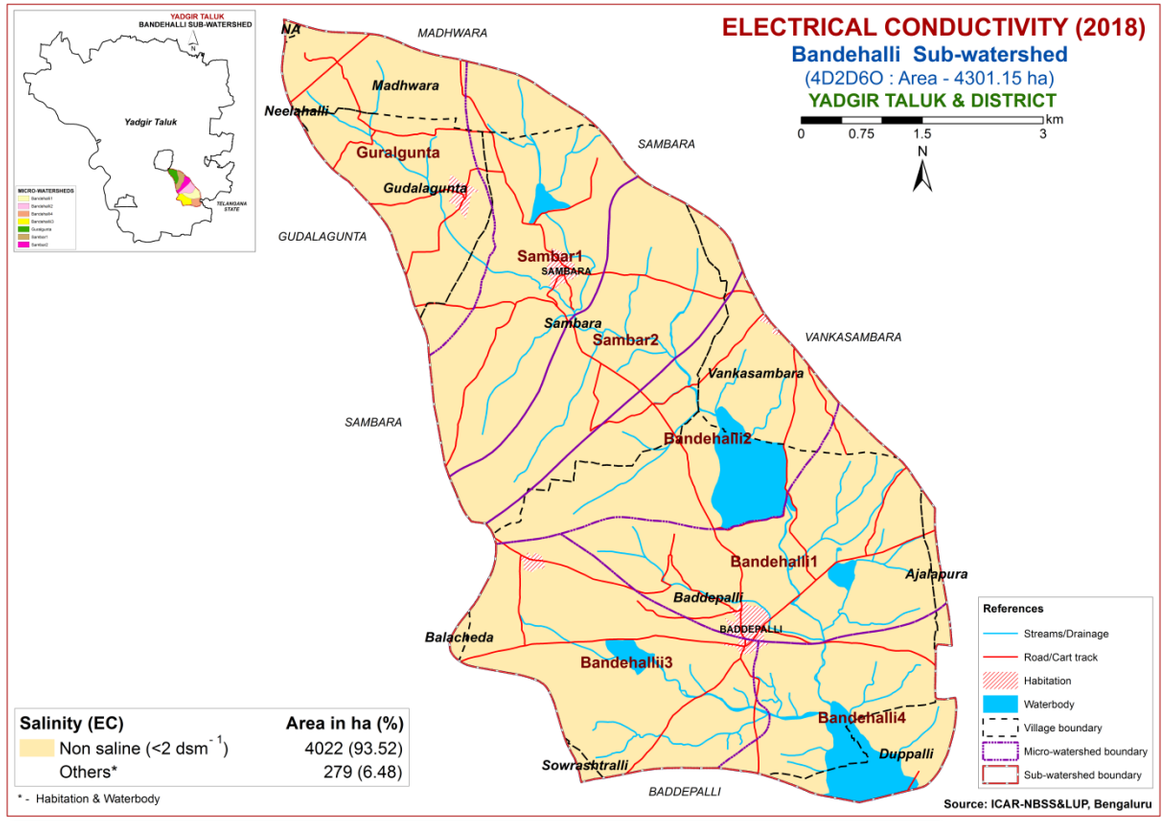


Reaction Class	Area in ha (%)
Moderately acid (pH 5.5 – 6.0)	0 (0.0)
Slightly acid (pH 6.0 – 6.5)	170 (3.95)
Neutral (pH 6.5 – 7.3)	909 (21.14)
Slightly alkaline (pH 7.3 – 7.8)	1166 (27.12)
Moderately alkaline (pH 7.8 – 8.4)	1126 (26.18)
Strongly alkaline (pH 8.4 – 9.0)	398 (9.26)
Very strongly alkaline (pH > 9.0)	253 (5.88)
Others*	279 (6.48)

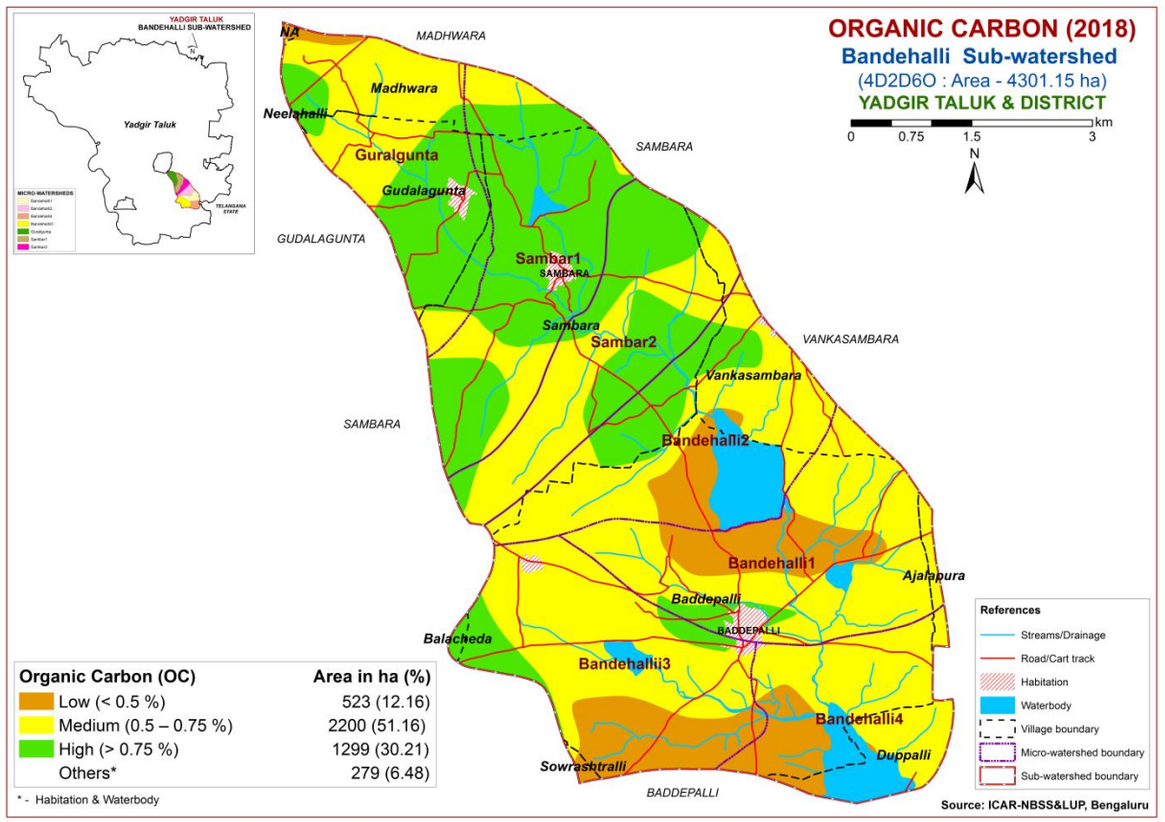
* - Habitation & Waterbody

Source: ICAR-NBSS&LUP, Bengaluru

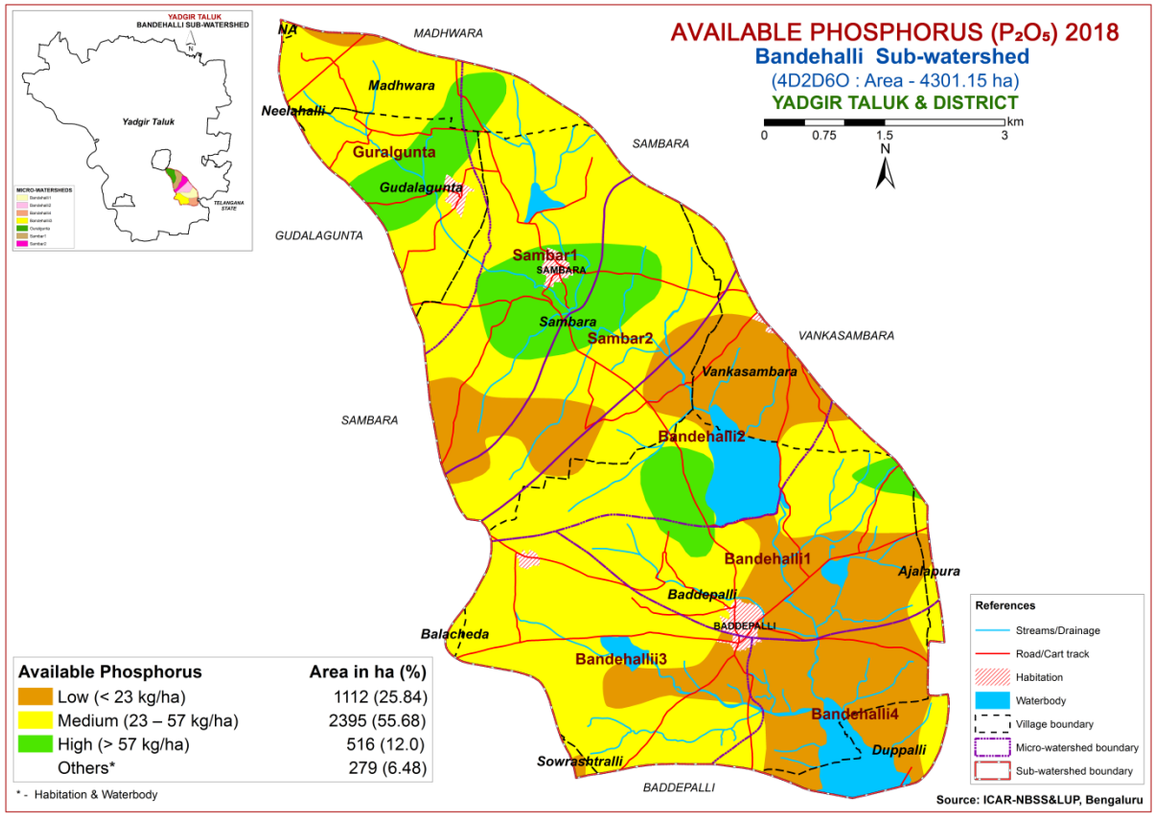
6.2 Electrical Conductivity (EC)



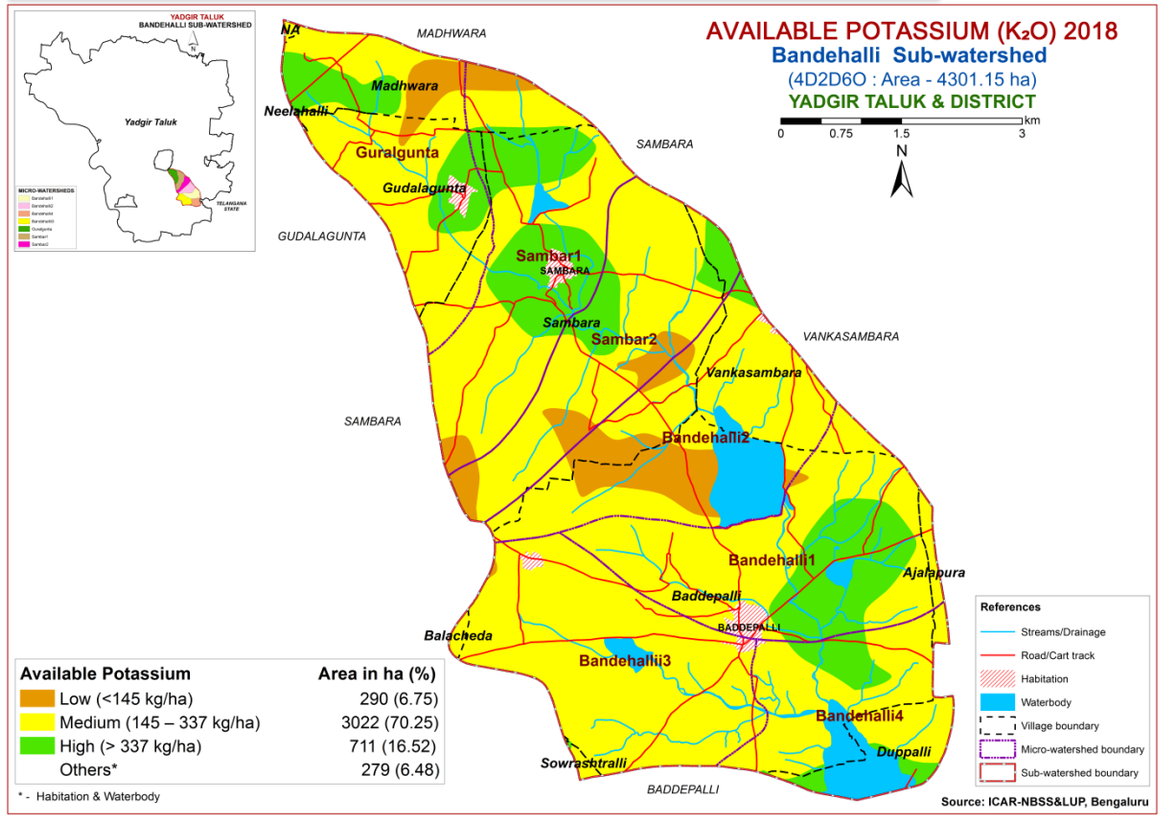
6.3. Organic Carbon



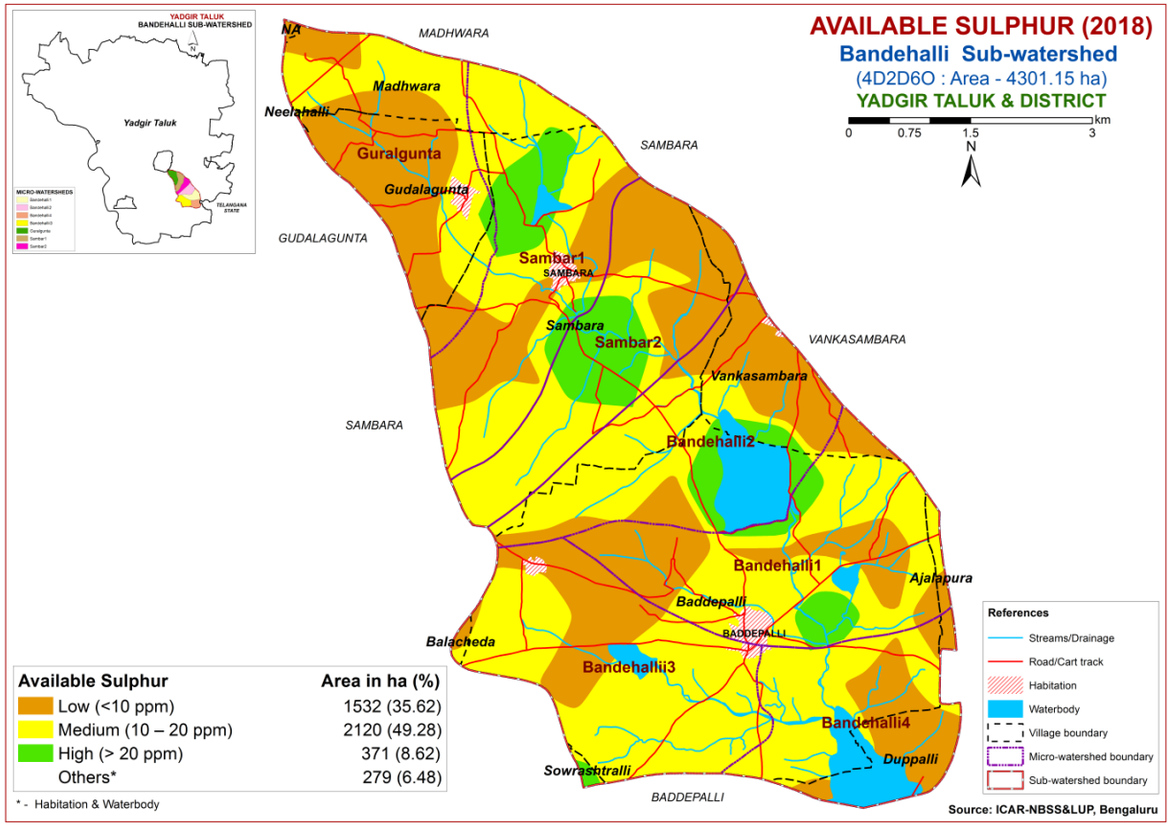
6.4. Available Phosphorus (P_2O_5)



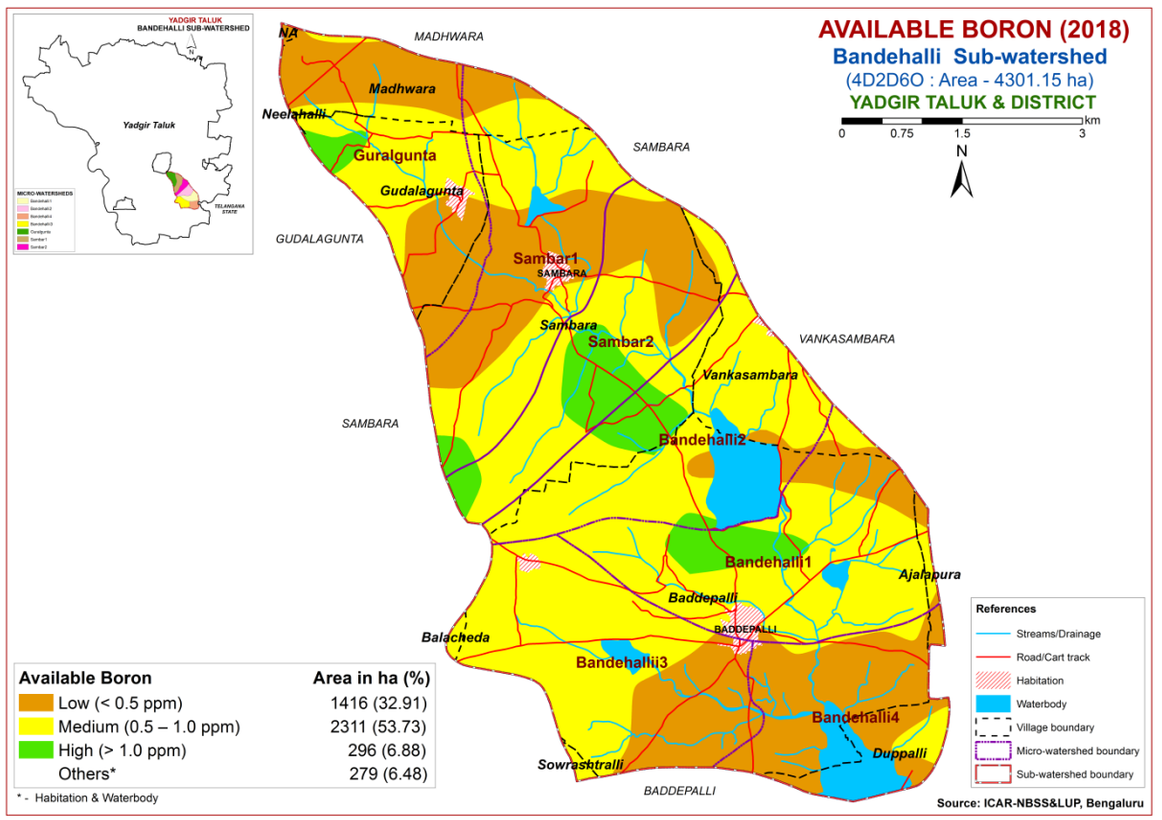
6.5. Available Potassium (K_2O)



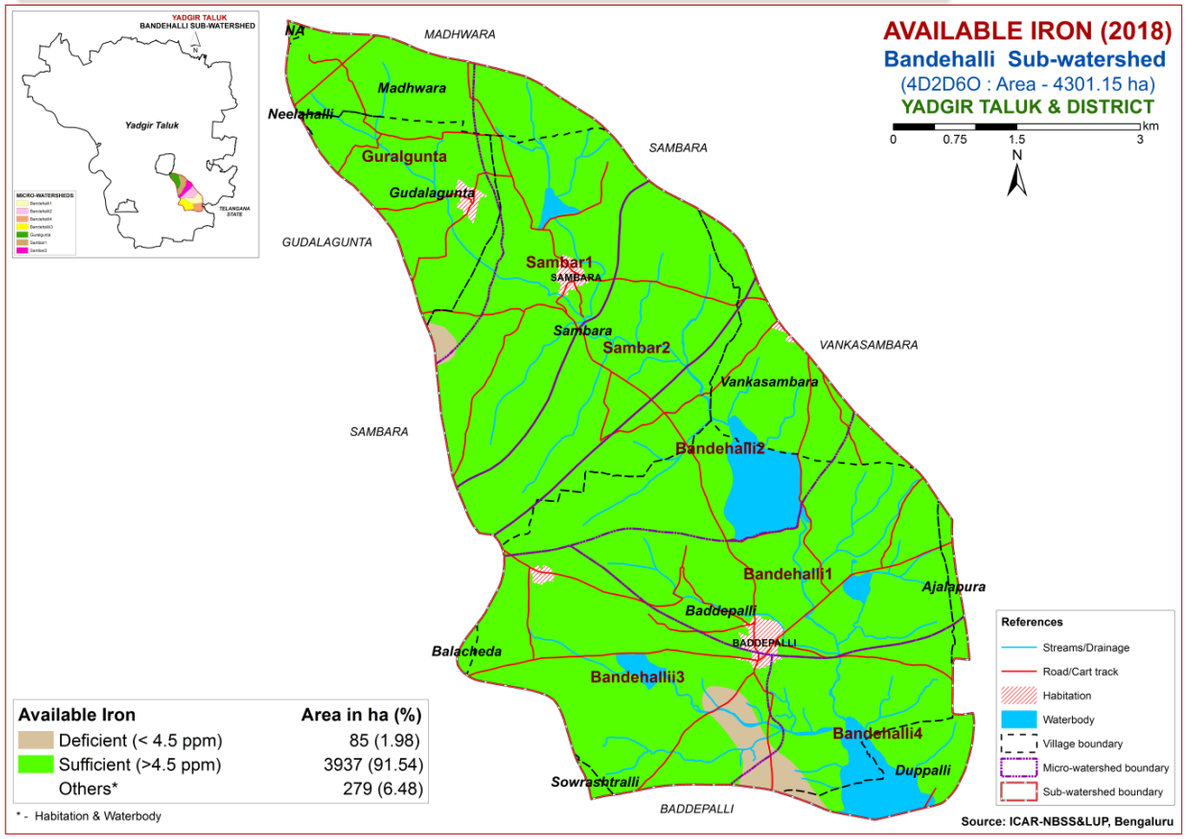
6.6. Available Sulphur



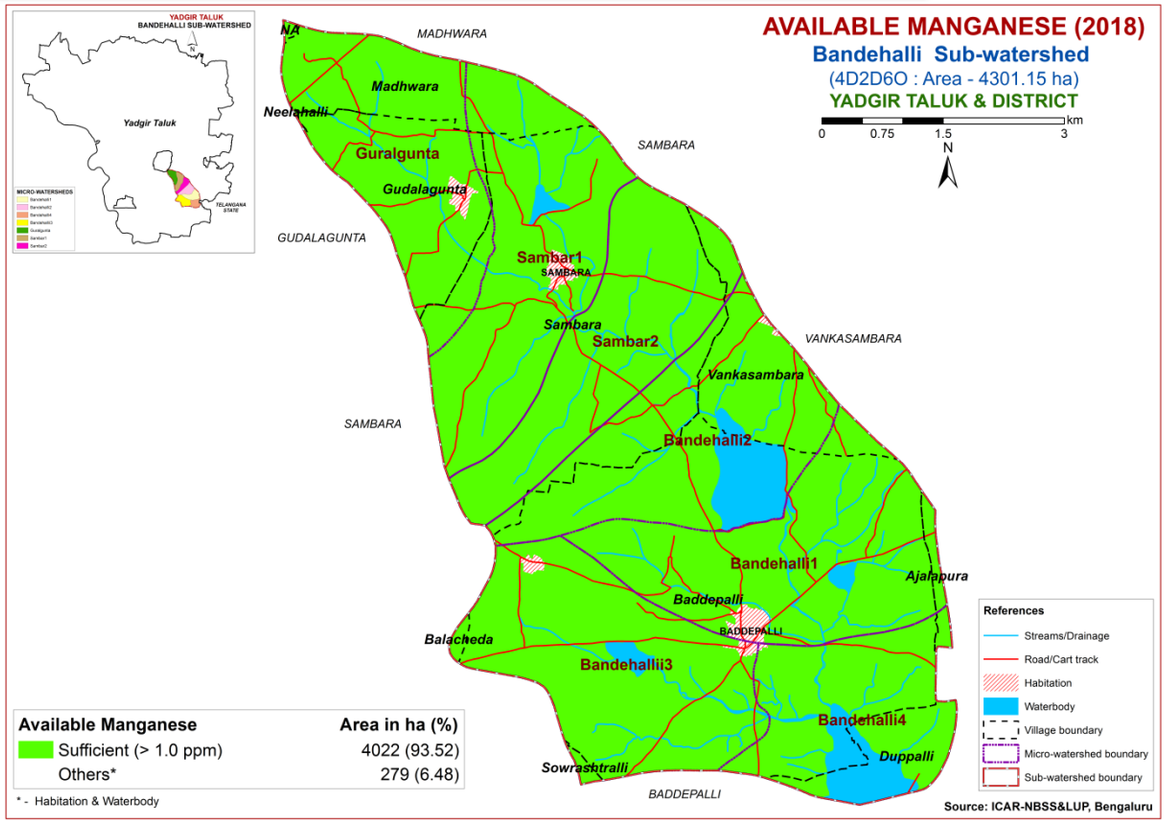
6.7. Available Boron



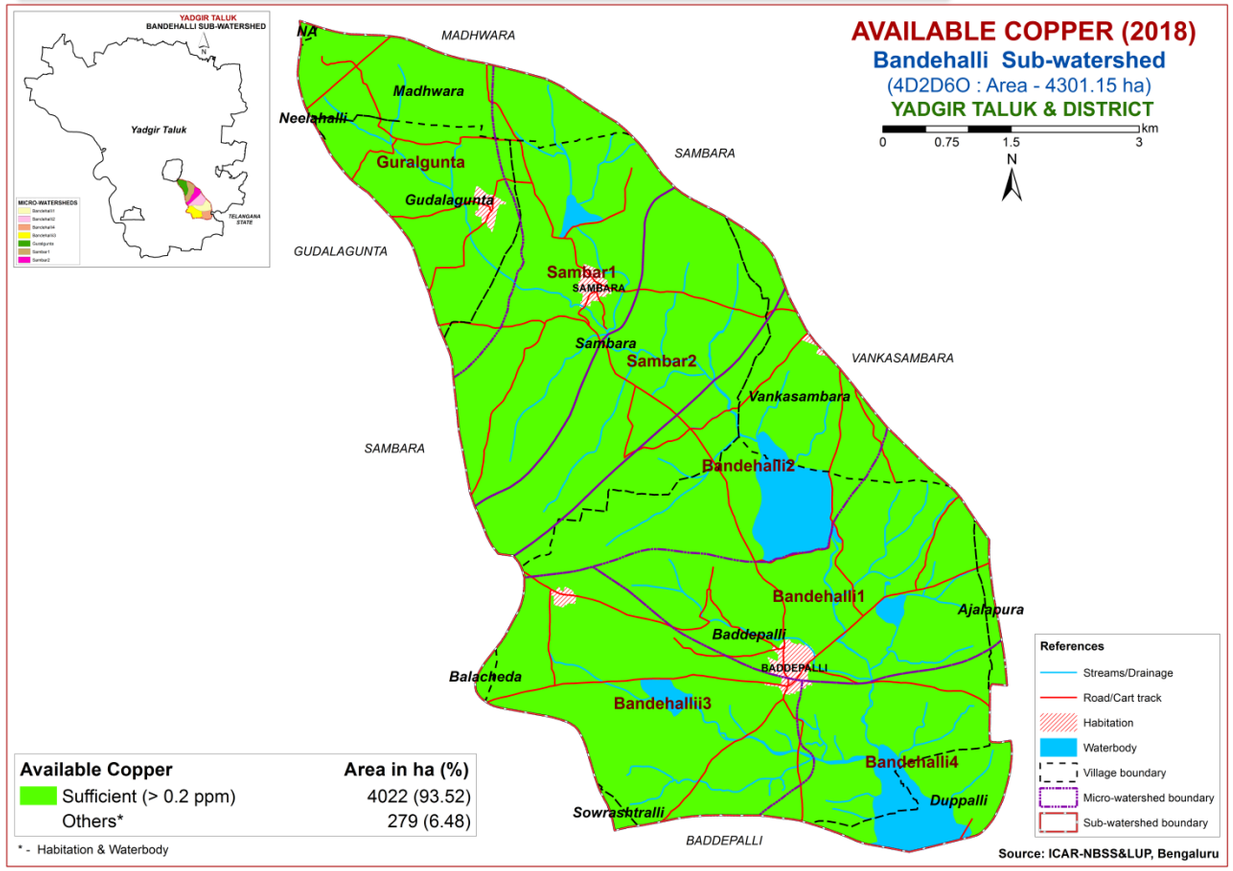
6.8. Available Iron



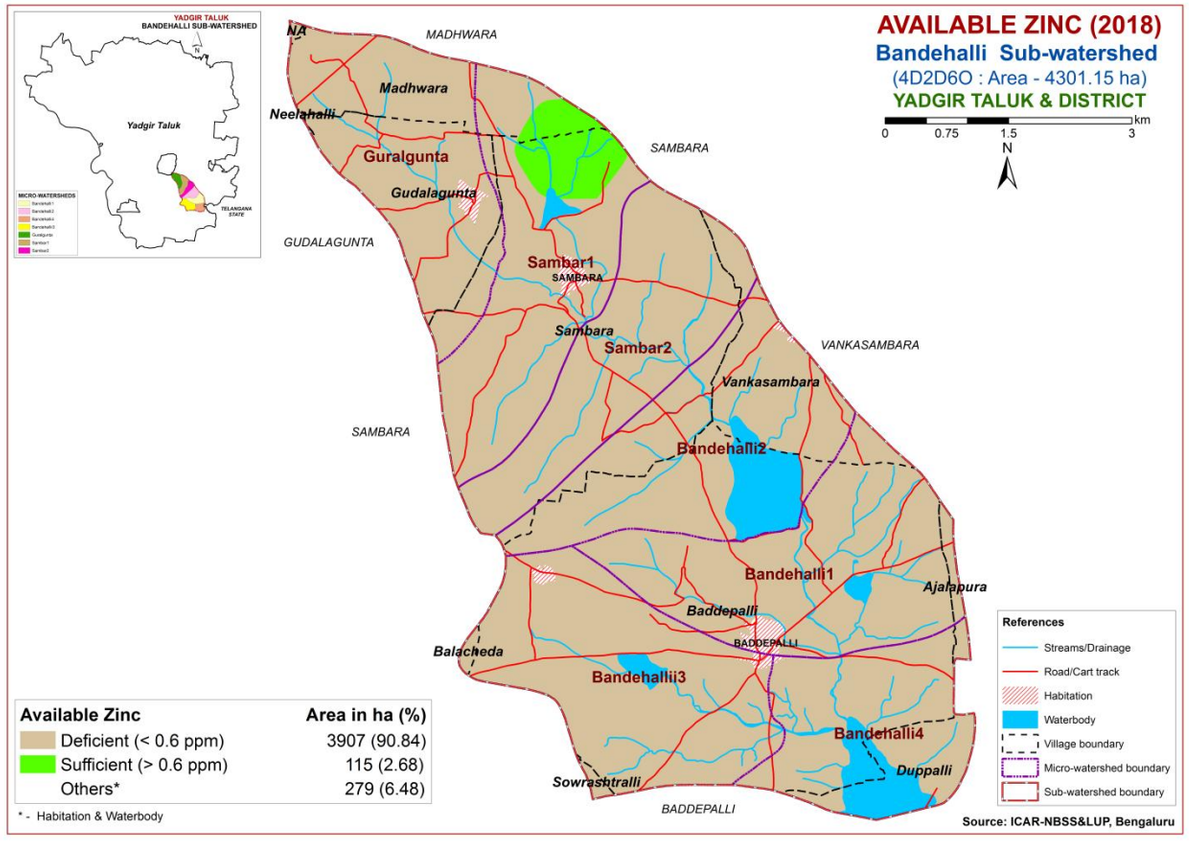
6.9. Available Manganese



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

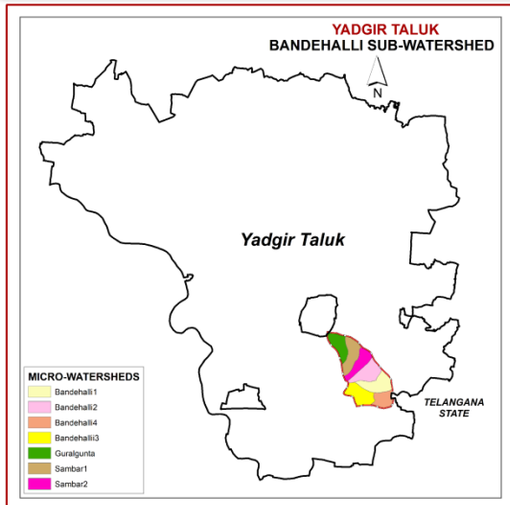
  100+25% for deficient soil.
  100% for medium available N content soil.
  100-25% for higher N content soil.

- 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

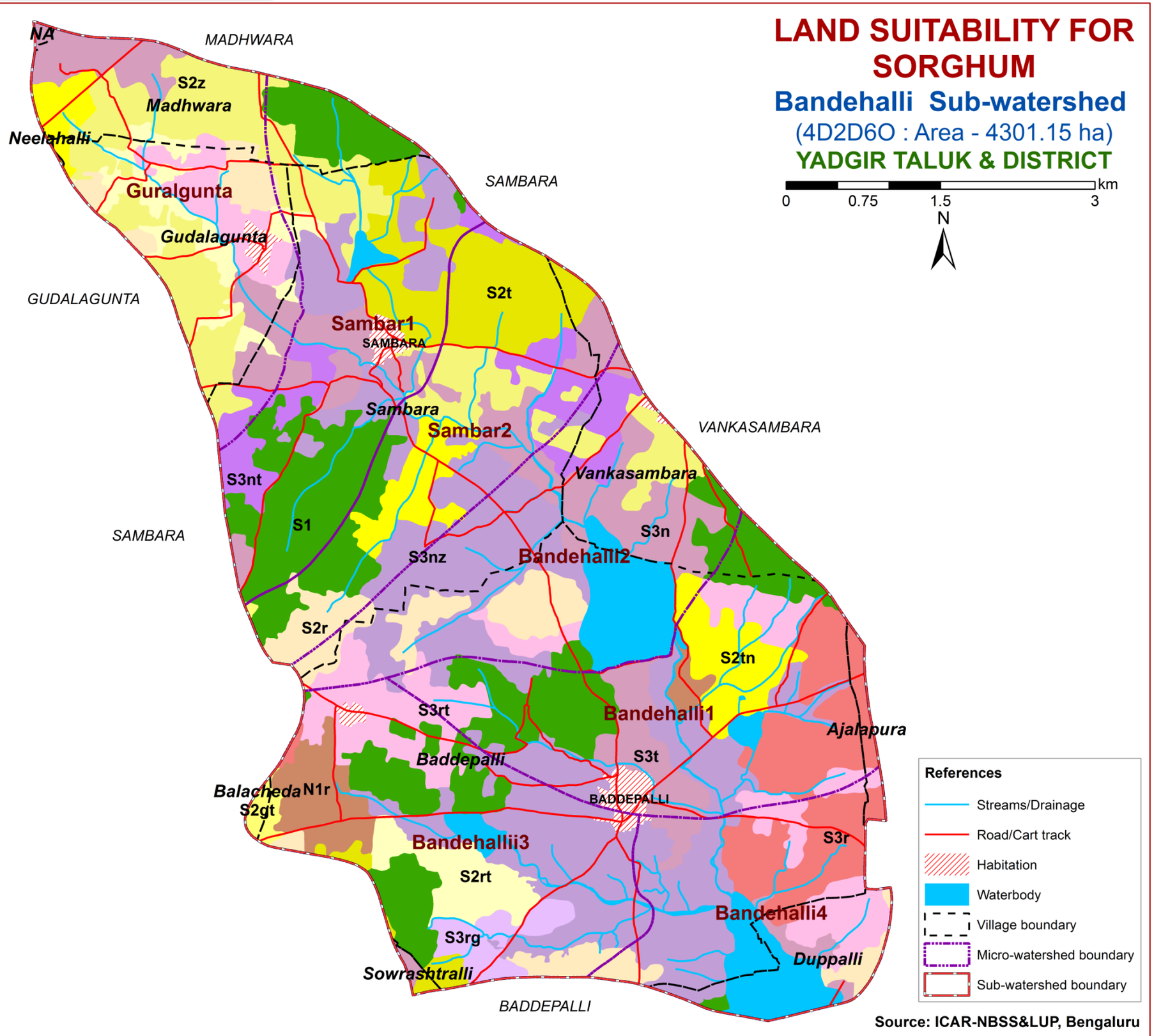


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

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

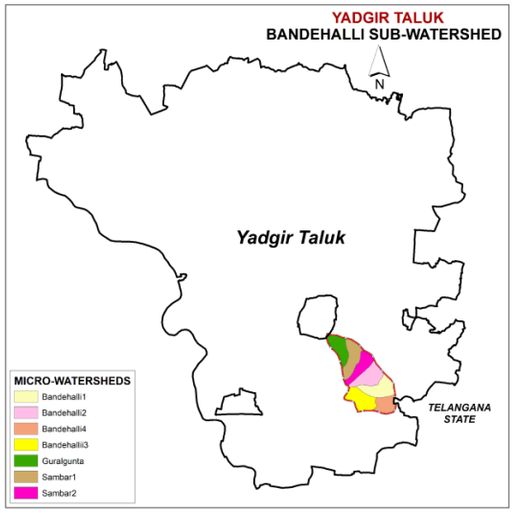
Suitability subclass	Area in ha (%)
S1	592 (13.76)
S2r	224 (5.21)
S2t	228 (5.29)
S2z	414 (9.62)
S2gt	17 (0.4)
S2rt	163 (3.79)
S2tn	186 (4.32)
S3n	276 (6.41)
S3r	248 (5.78)
S3t	187 (4.34)
S3nt	148 (3.45)
S3nz	860 (20.0)
S3rg	53 (1.23)
S3rt	337 (7.83)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody



Source: ICAR-NBSS&LUP, Bengaluru

7.2. Land Suitability for Maize

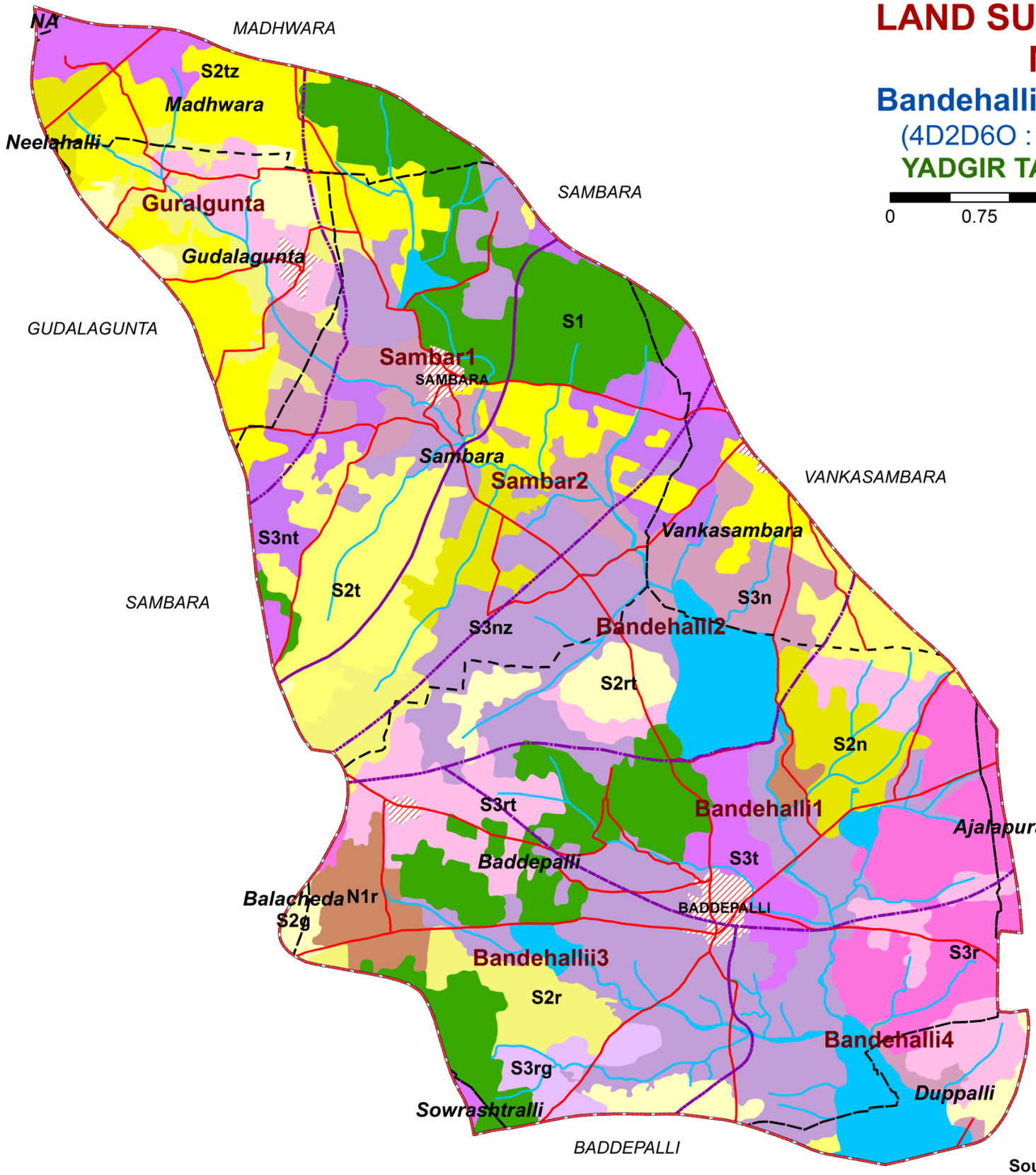


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

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

Suitability subclass	Area in ha (%)
S1	528 (12.27)
S2g	17 (0.4)
S2n	186 (4.32)
S2r	225 (5.23)
S2t	292 (6.78)
S2rt	162 (3.77)
S2tz	414 (9.62)
S3n	276 (6.41)
S3r	248 (5.78)
S3t	187 (4.34)
S3nt	148 (3.45)
S3nz	860 (20.0)
S3rg	53 (1.23)
S3rt	337 (7.83)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody



LAND SUITABILITY FOR MAIZE

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

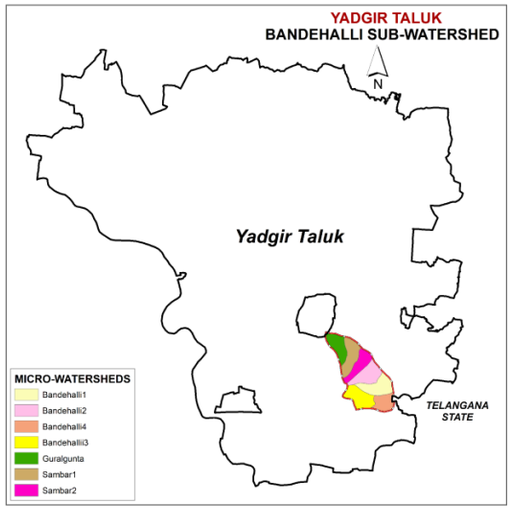
0 0.75 1.5 3 km

N

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.3. Land Suitability for Redgram

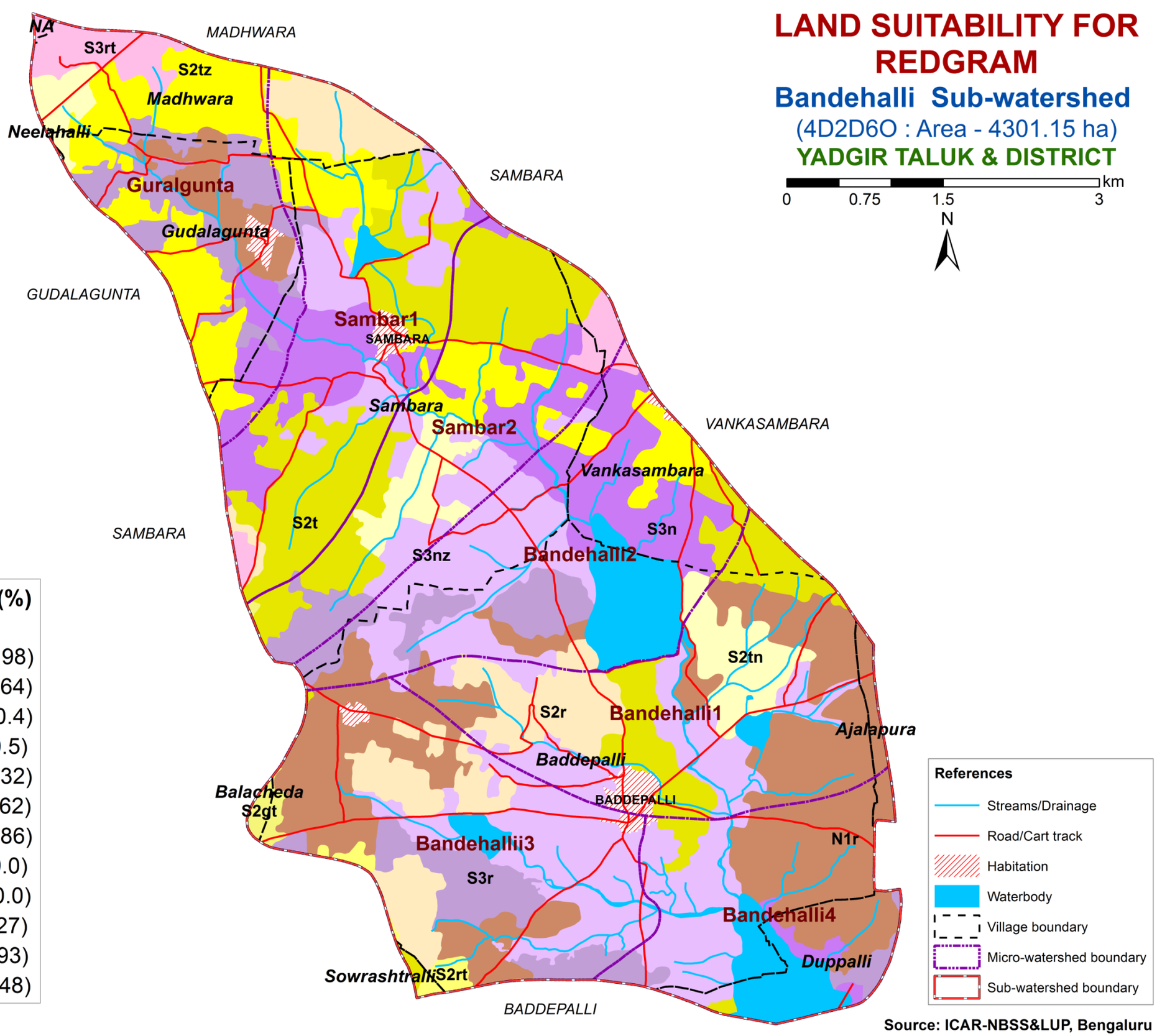


Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

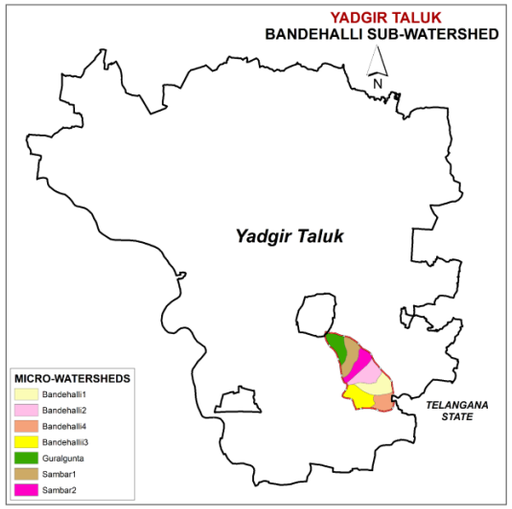
Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

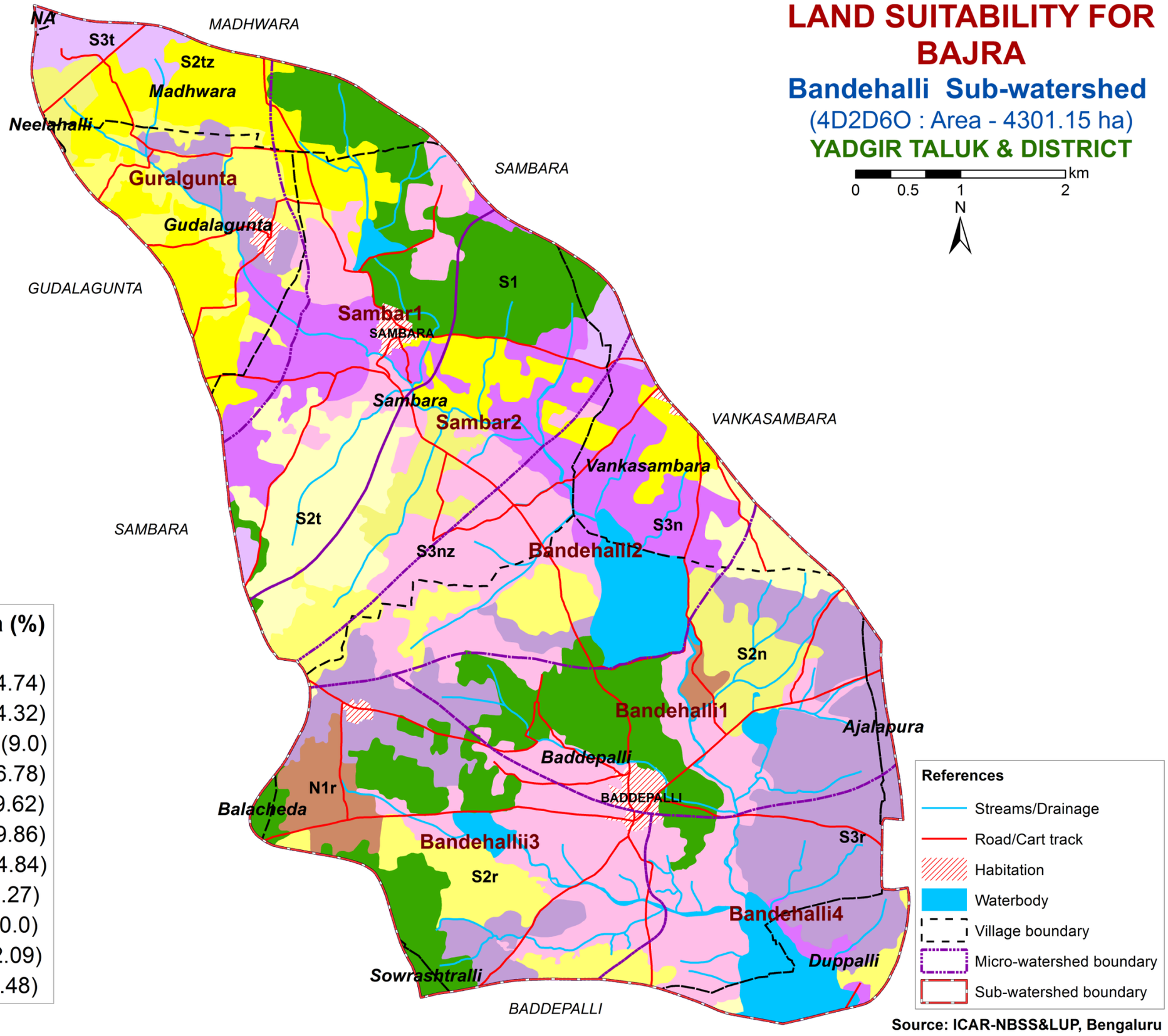
Suitability subclass	Area in ha (%)
S2r	300 (6.98)
S2t	587 (13.64)
S2gt	17 (0.4)
S2rt	22 (0.5)
S2tn	186 (4.32)
S2tz	414 (9.62)
S3n	424 (9.86)
S3r	387 (9.0)
S3nz	860 (20.0)
S3rt	98 (2.27)
N1r	728 (16.93)
Others*	279 (6.48)

* - Habitation & Waterbody



7.4. Land Suitability for Bajra





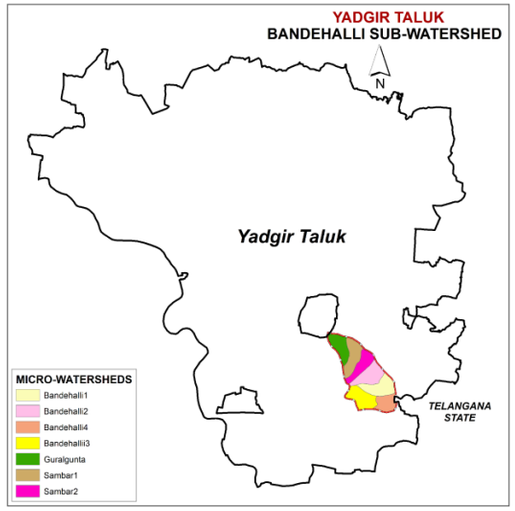
Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

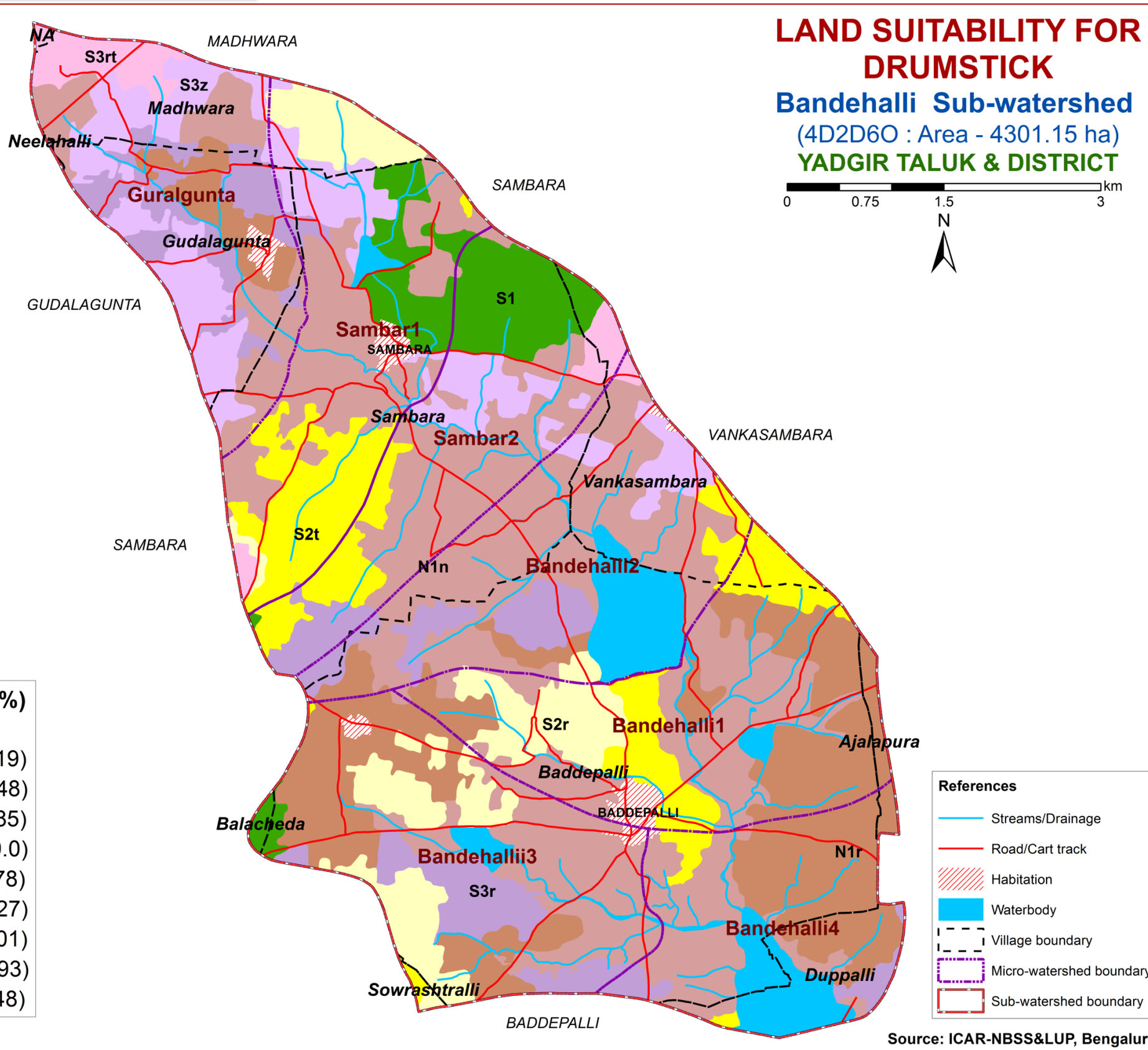
Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	634 (14.74)
S2n	186 (4.32)
S2r	387 (9.0)
S2t	292 (6.78)
S2tz	414 (9.62)
S3n	424 (9.86)
S3r	638 (14.84)
S3t	98 (2.27)
S3nz	860 (20.0)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody

7.5. Land Suitability for Drumstick





LAND SUITABILITY FOR DRUMSTICK

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

N

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

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

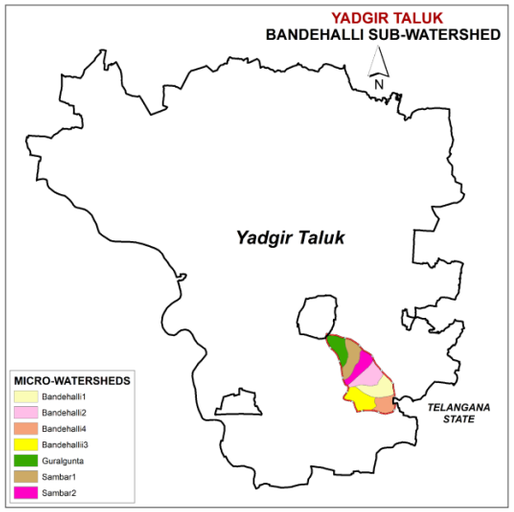
Suitability subclass	Area in ha (%)
S1	223 (5.19)
S2r	322 (7.48)
S2t	381 (8.85)
S3r	387 (9.0)
S3z	377 (8.78)
S3rt	98 (2.27)
N1n	1506 (35.01)
N1r	728 (16.93)
Others*	279 (6.48)

* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.6. Land Suitability for Sunflower

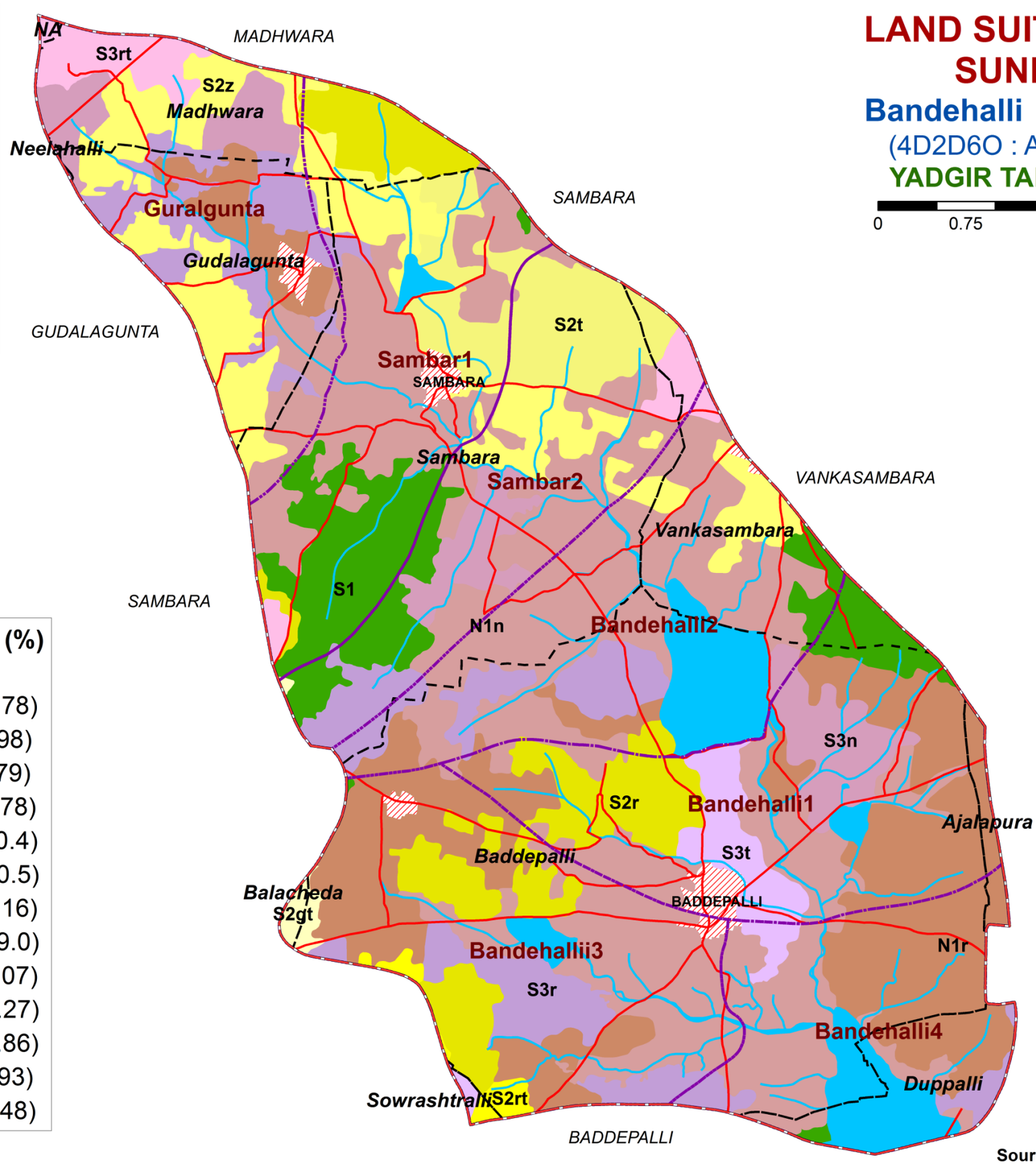


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

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

Suitability subclass	Area in ha (%)
S1	292 (6.78)
S2r	300 (6.98)
S2t	206 (4.79)
S2z	377 (8.78)
S2gt	17 (0.4)
S2rt	22 (0.5)
S3n	222 (5.16)
S3r	387 (9.0)
S3t	89 (2.07)
S3rt	98 (2.27)
N1n	1284 (29.86)
N1r	728 (16.93)
Others*	279 (6.48)

* - Habitation & Waterbody



LAND SUITABILITY FOR SUNFLOWER

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

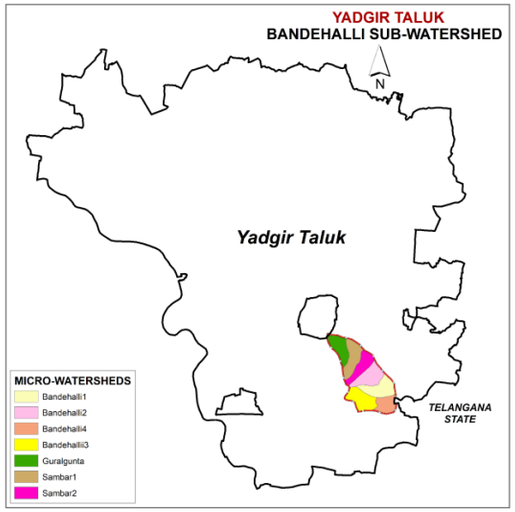
0 0.75 1.5 3 km

N

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.7. Land Suitability for Cotton

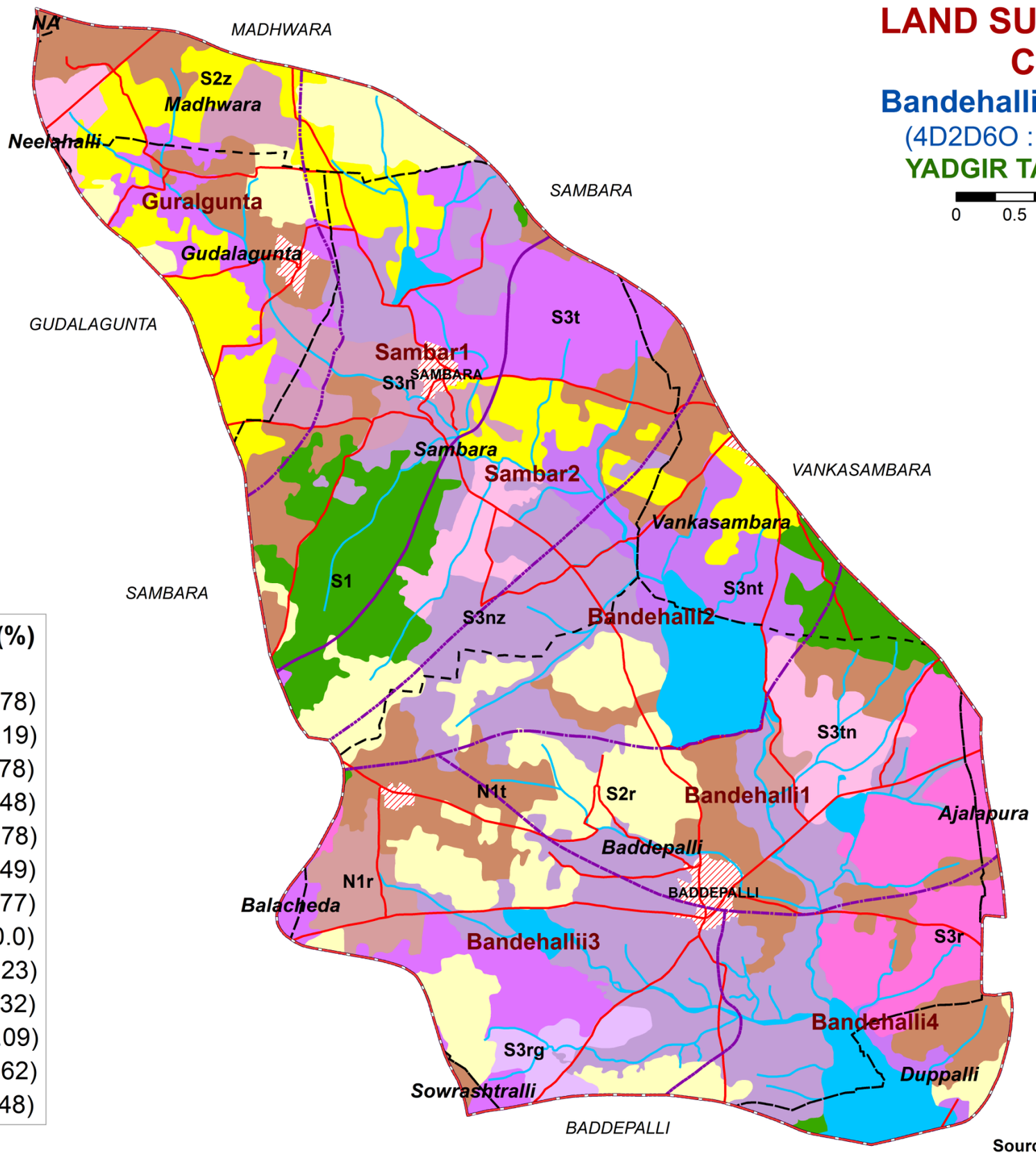


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

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

Suitability subclass	Area in ha (%)
S1	292 (6.78)
S2r	524 (12.19)
S2z	377 (8.78)
S3n	150 (3.48)
S3r	248 (5.78)
S3t	408 (9.49)
S3nt	162 (3.77)
S3nz	860 (20.0)
S3rg	53 (1.23)
S3tn	186 (4.32)
N1r	90 (2.09)
N1t	672 (15.62)
Others*	279 (6.48)

* - Habitation & Waterbody



LAND SUITABILITY FOR COTTON

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

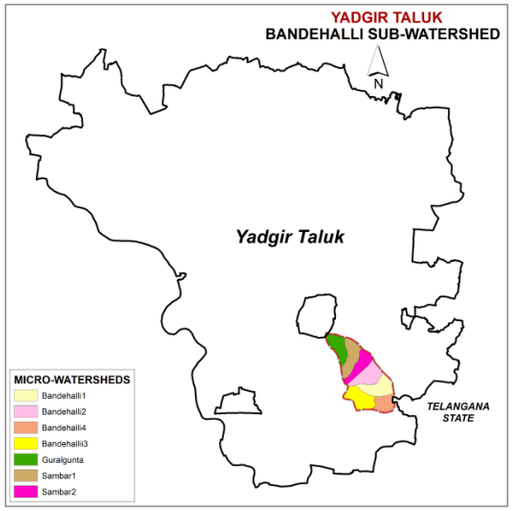
0 0.5 1 2 km

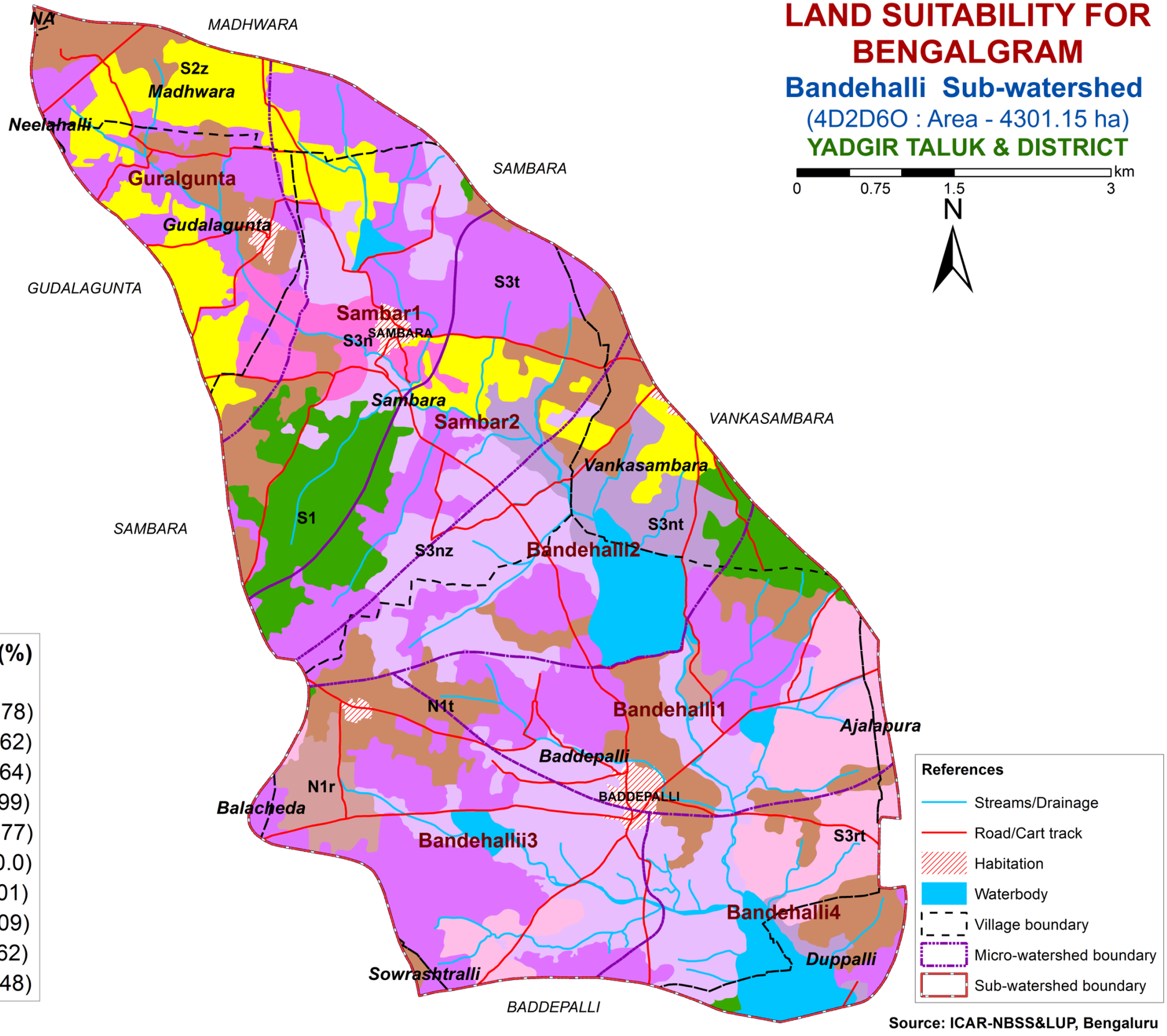
N

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.8. Land Suitability for Bengalgram





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

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

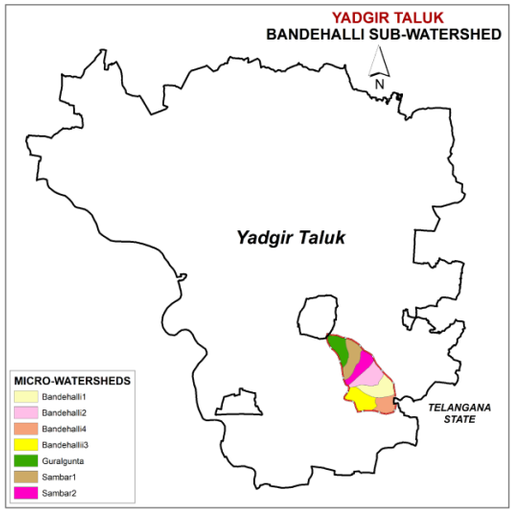
Suitability subclass	Area in ha (%)
S1	292 (6.78)
S2z	414 (9.62)
S3n	113 (2.64)
S3t	1118 (25.99)
S3nt	162 (3.77)
S3nz	860 (20.0)
S3rt	301 (7.01)
N1r	90 (2.09)
N1t	672 (15.62)
Others*	279 (6.48)

* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.9. Land Suitability for Groundnut

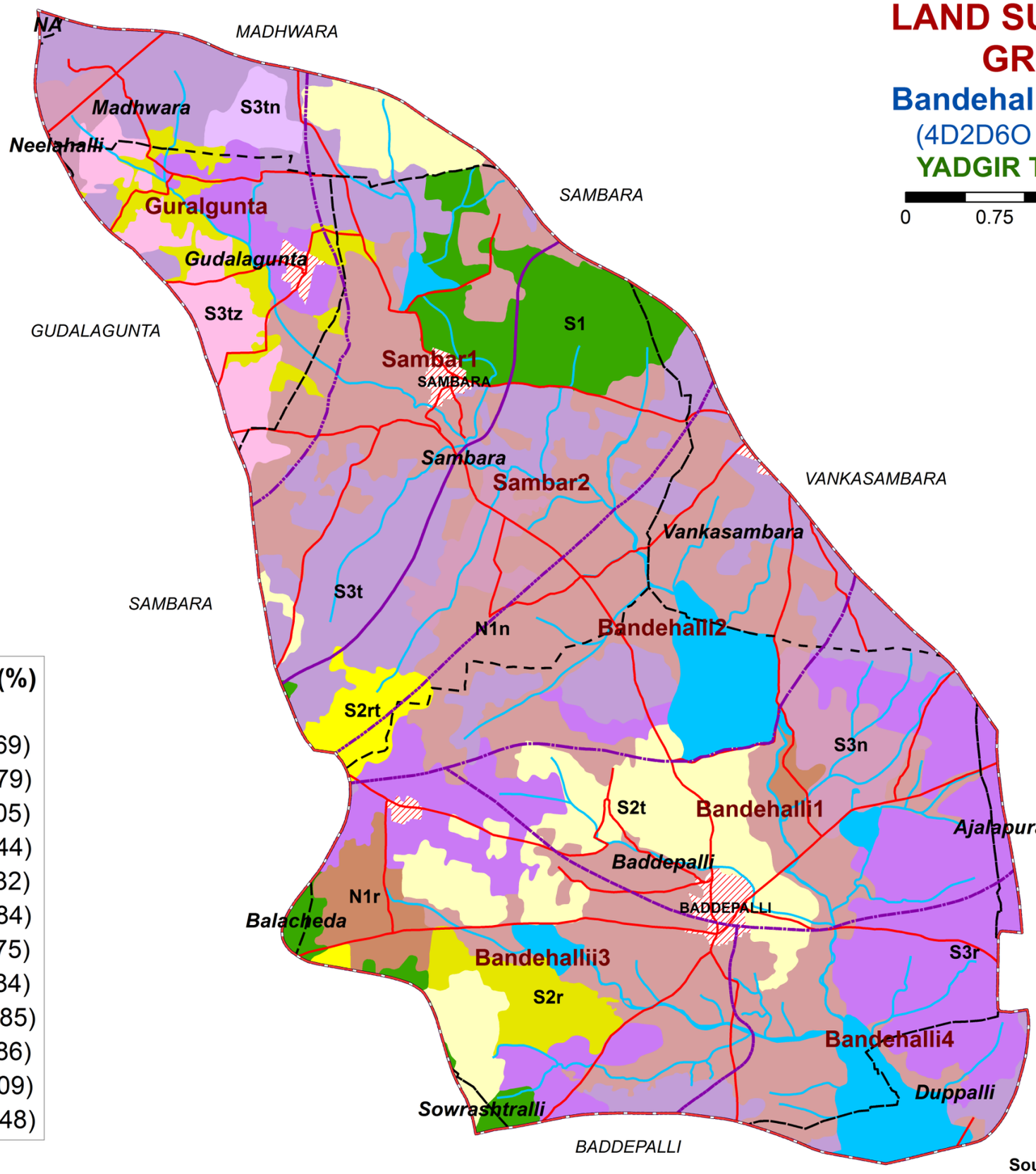


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	245 (5.69)
S2r	163 (3.79)
S2t	389 (9.05)
S2rt	62 (1.44)
S3n	186 (4.32)
S3r	638 (14.84)
S3t	806 (18.75)
S3tn	36 (0.84)
S3tz	123 (2.85)
N1n	1284 (29.86)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody



LAND SUITABILITY FOR GROUNDNUT

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

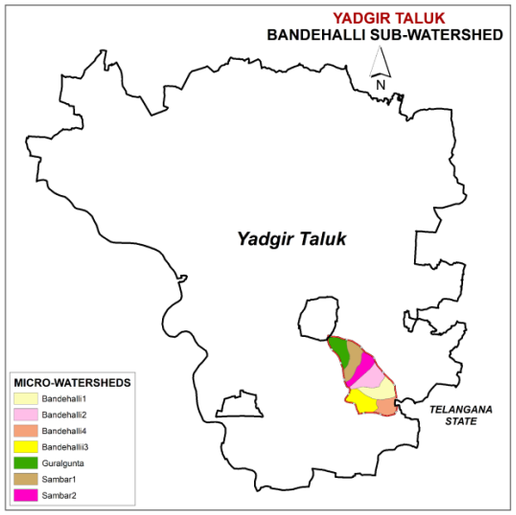
0 0.75 1.5 3 km

N

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.10. Land Suitability for Chilli

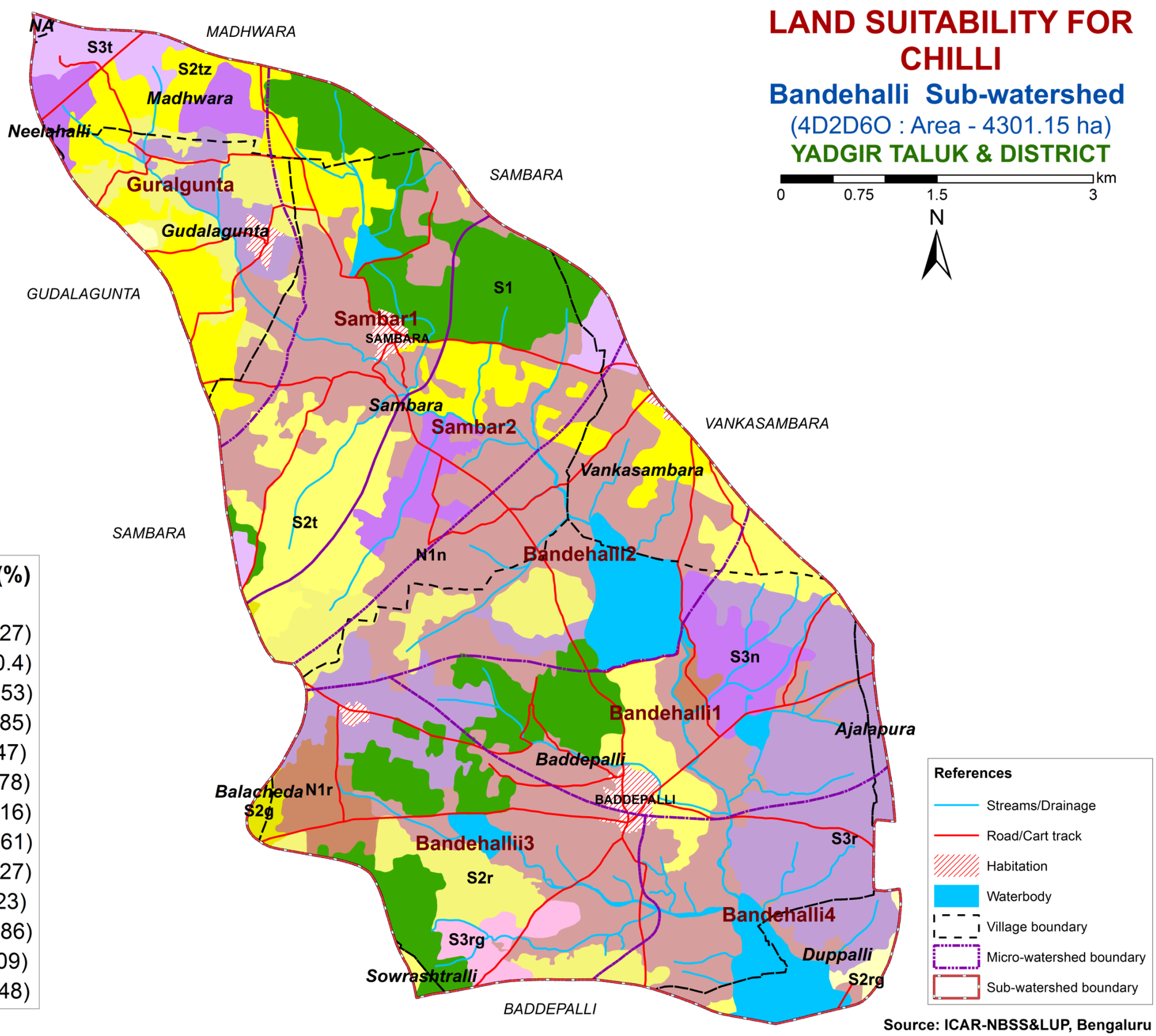


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

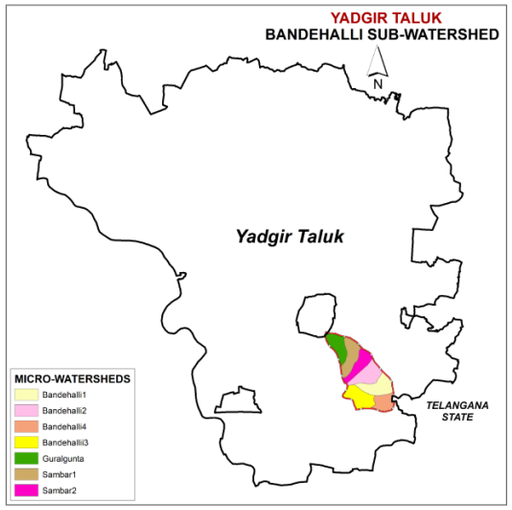
Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

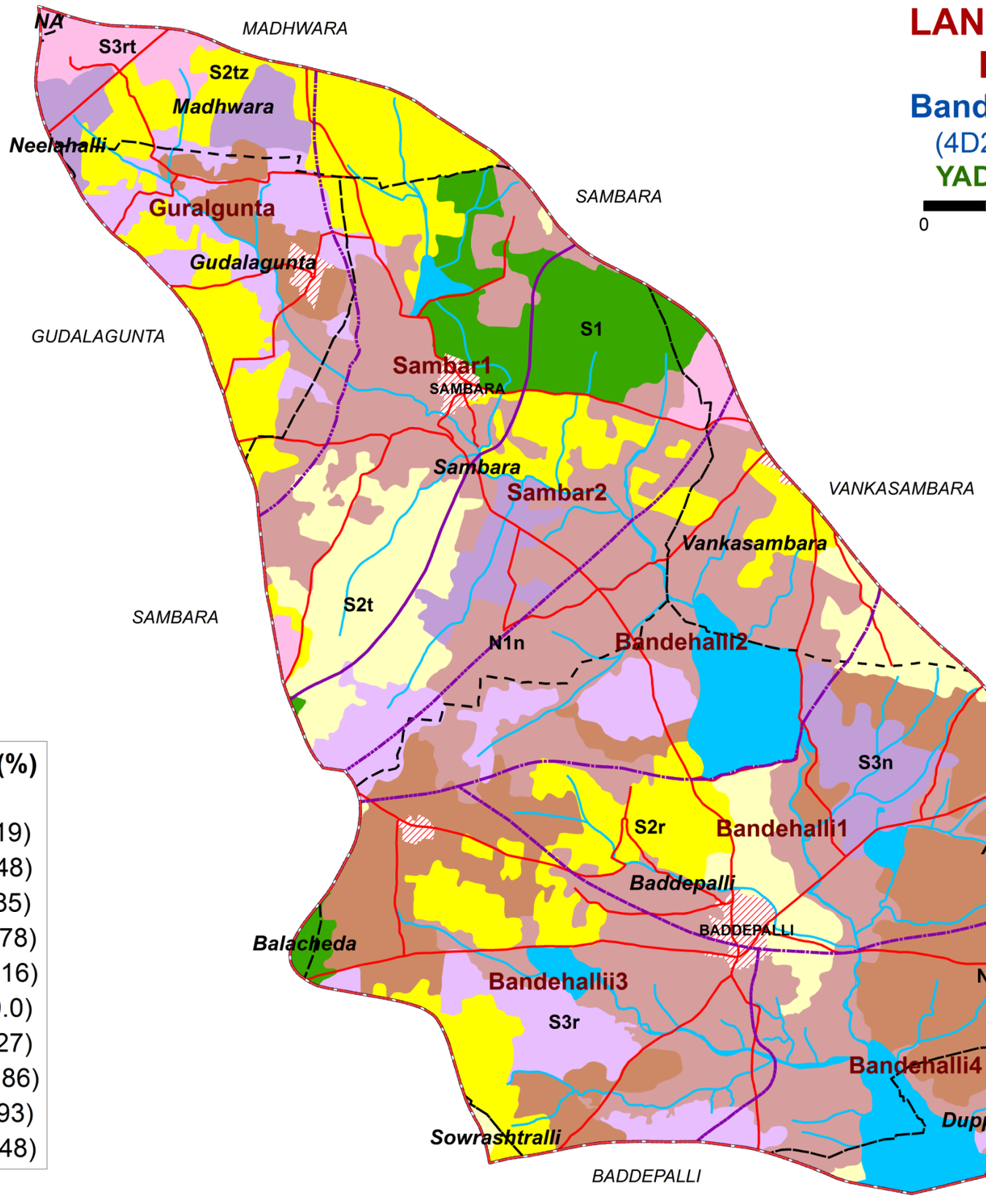
Suitability subclass	Area in ha (%)
S1	528 (12.27)
S2g	17 (0.4)
S2r	367 (8.53)
S2t	381 (8.85)
S2rg	20 (0.47)
S2tz	377 (8.78)
S3n	222 (5.16)
S3r	585 (13.61)
S3t	98 (2.27)
S3rg	53 (1.23)
N1n	1284 (29.86)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody



7.11. Land Suitability for Pomegranate





LAND SUITABILITY FOR POMEGRANATE

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

N

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

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

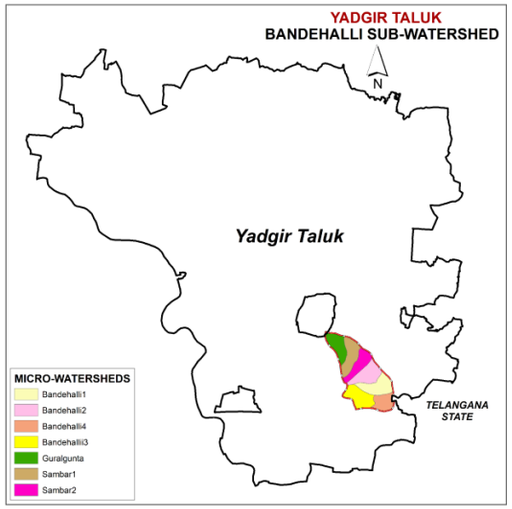
Suitability subclass	Area in ha (%)
S1	223 (5.19)
S2r	322 (7.48)
S2t	381 (8.85)
S2tz	377 (8.78)
S3n	222 (5.16)
S3r	387 (9.0)
S3rt	98 (2.27)
N1n	1284 (29.86)
N1r	728 (16.93)
Others*	279 (6.48)

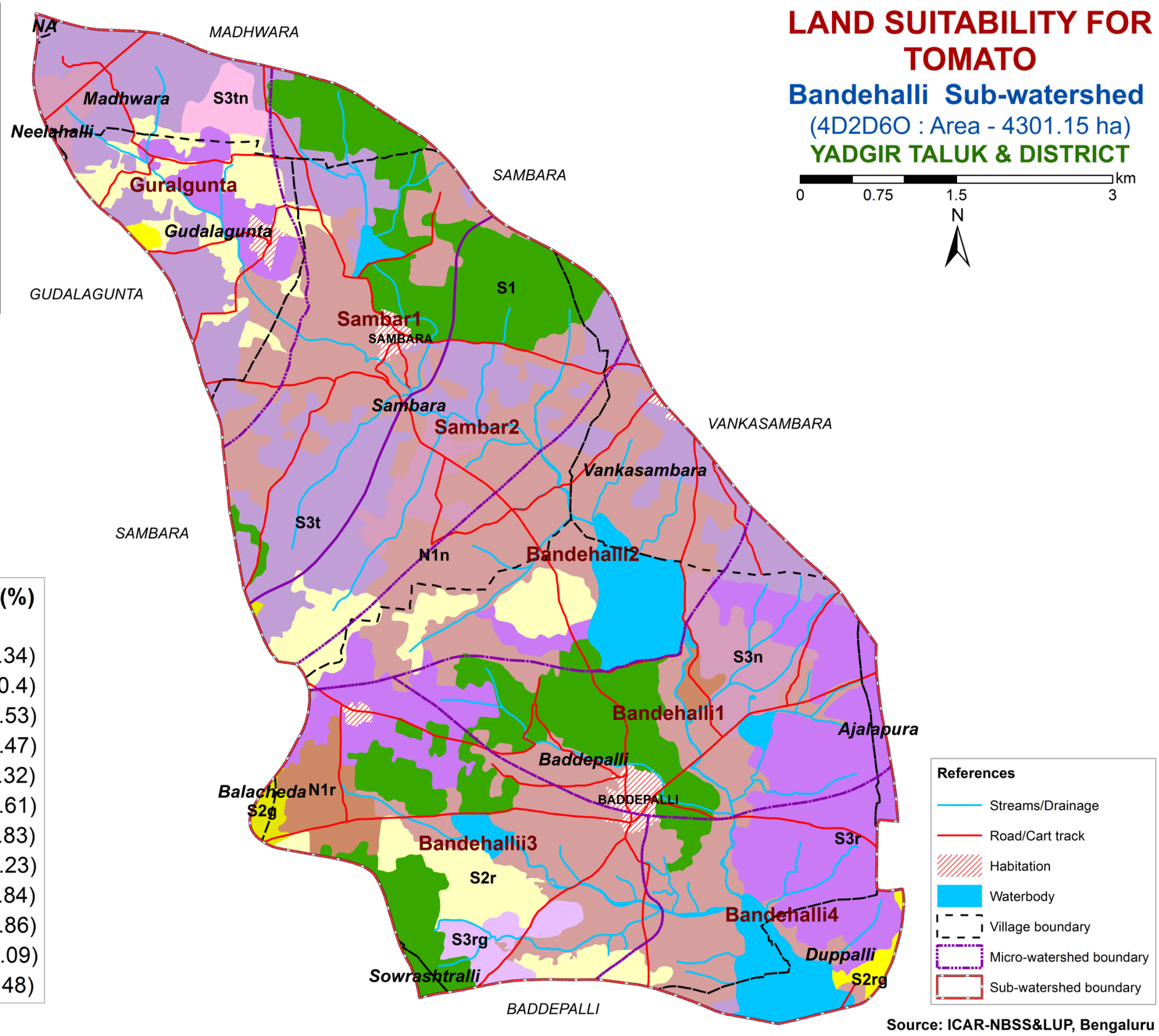
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.12. Land Suitability for Tomato





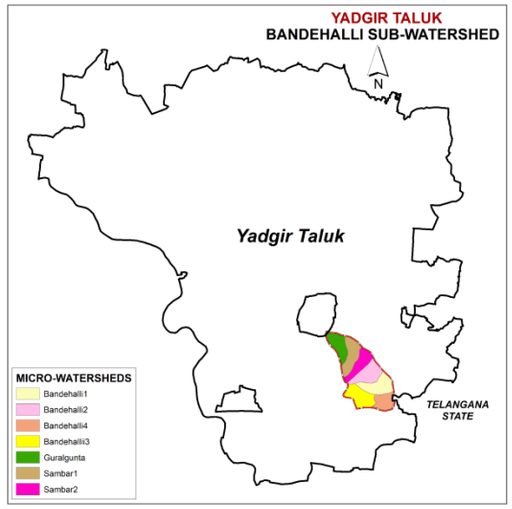
Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

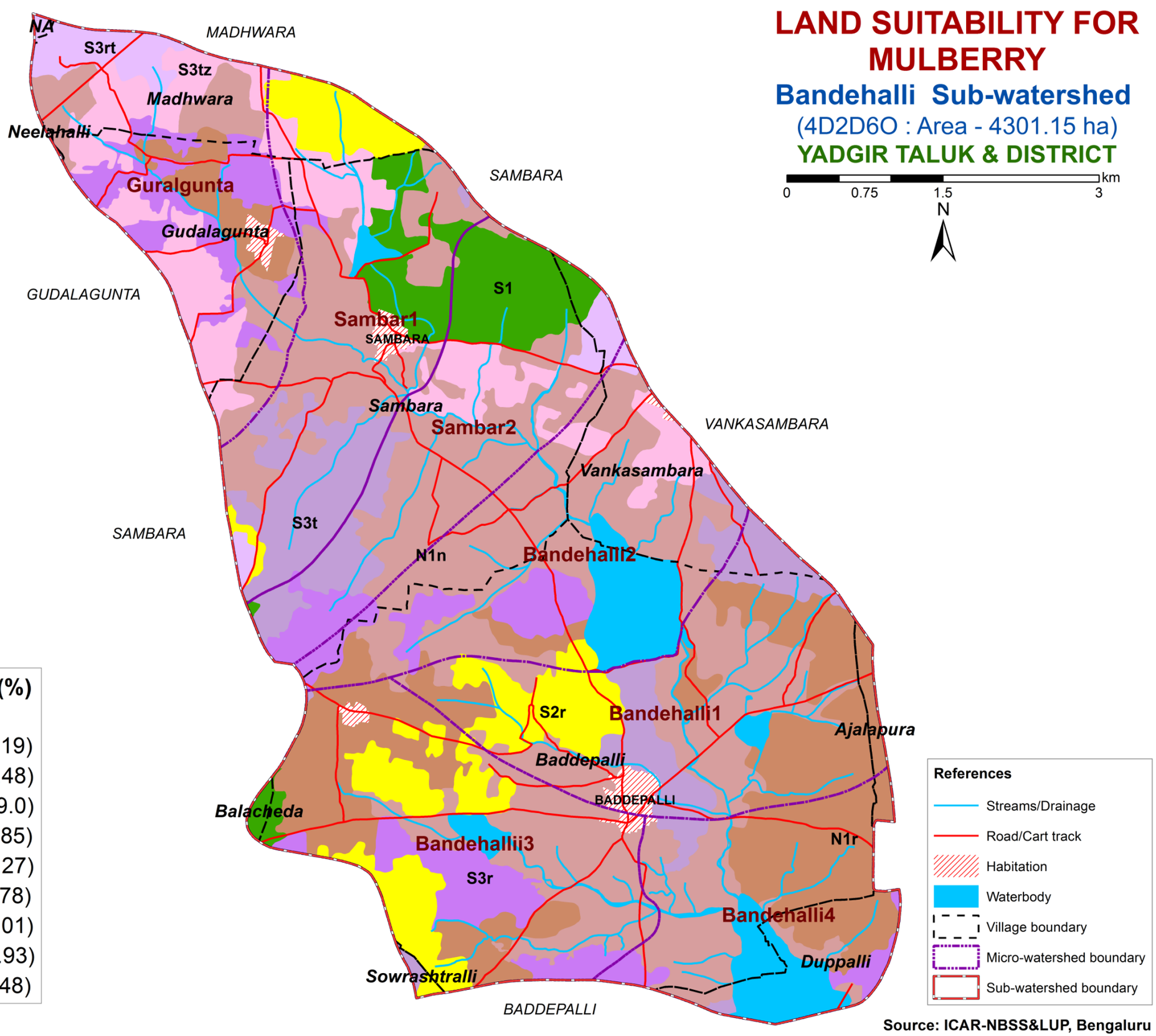
Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture

Suitability subclass	Area in ha (%)
S1	617 (14.34)
S2g	17 (0.4)
S2r	367 (8.53)
S2rg	20 (0.47)
S3n	186 (4.32)
S3r	585 (13.61)
S3t	767 (17.83)
S3rg	53 (1.23)
S3tn	36 (0.84)
N1n	1284 (29.86)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody

7.13. Land Suitability for Mulberry





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

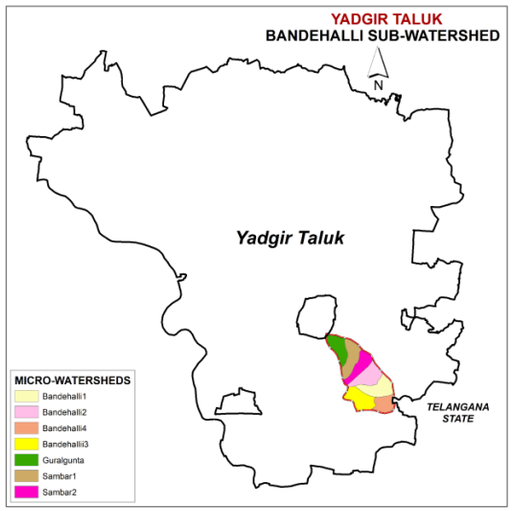
Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	223 (5.19)
S2r	322 (7.48)
S3r	387 (9.0)
S3t	381 (8.85)
S3rt	98 (2.27)
S3tz	377 (8.78)
N1n	1506 (35.01)
N1r	728 (16.93)
Others*	279 (6.48)

* - Habitation & Waterbody

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

7.14. Land Suitability for Bhendi

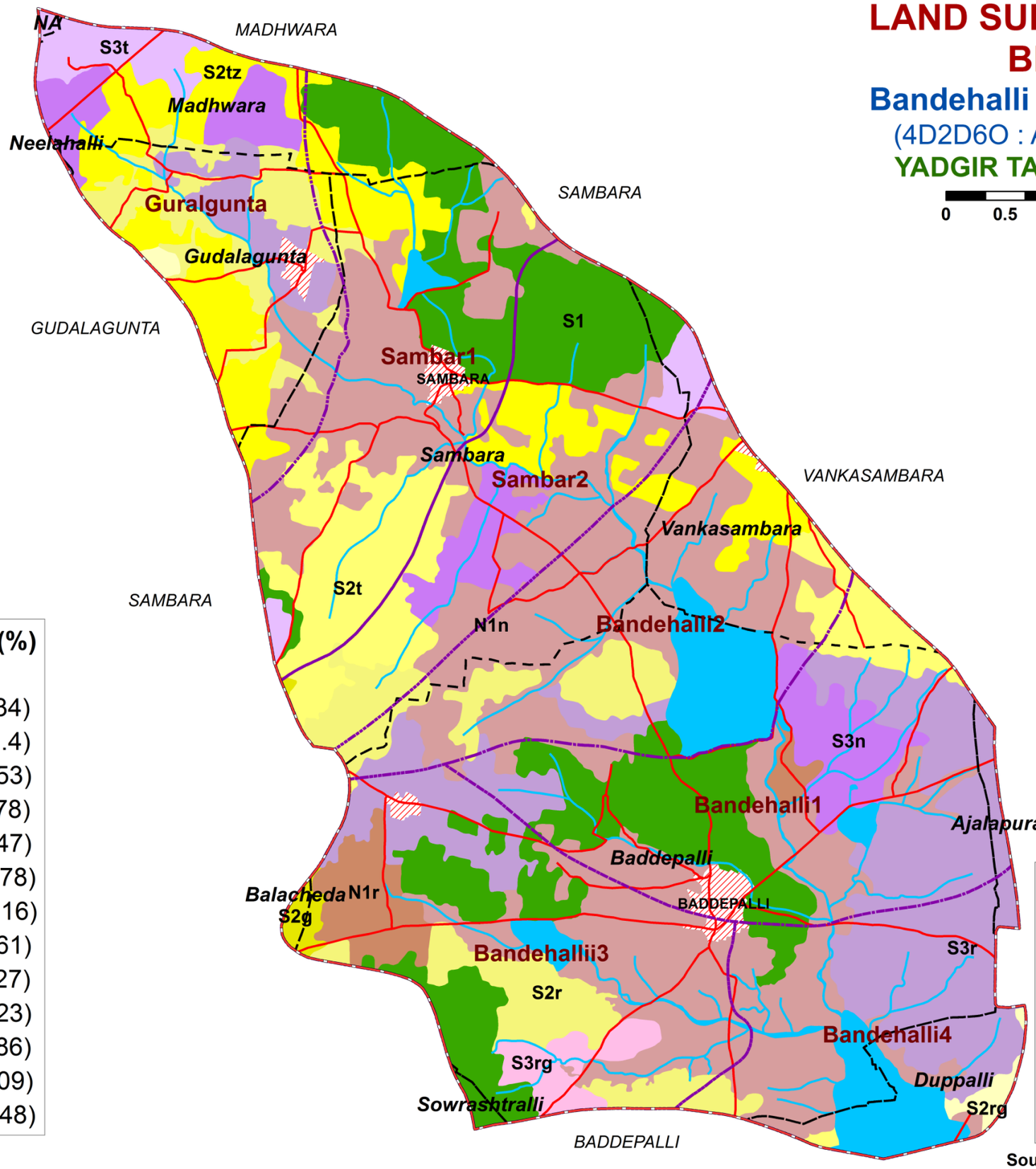


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

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

Suitability subclass	Area in ha (%)
S1	617 (14.34)
S2g	17 (0.4)
S2r	367 (8.53)
S2t	292 (6.78)
S2rg	20 (0.47)
S2tz	377 (8.78)
S3n	222 (5.16)
S3r	585 (13.61)
S3t	98 (2.27)
S3rg	53 (1.23)
N1n	1284 (29.86)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody



LAND SUITABILITY FOR BHENDI

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

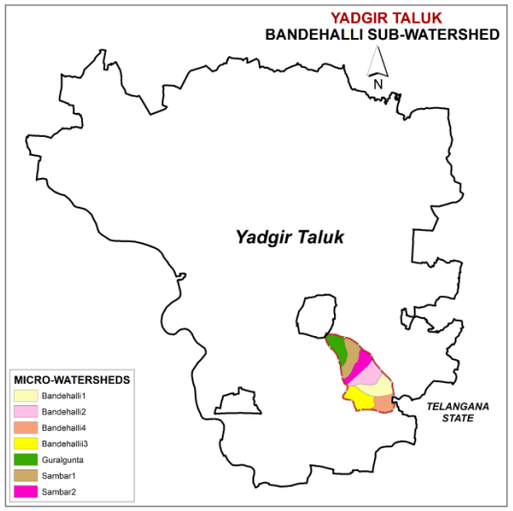
0 0.5 1 2 km

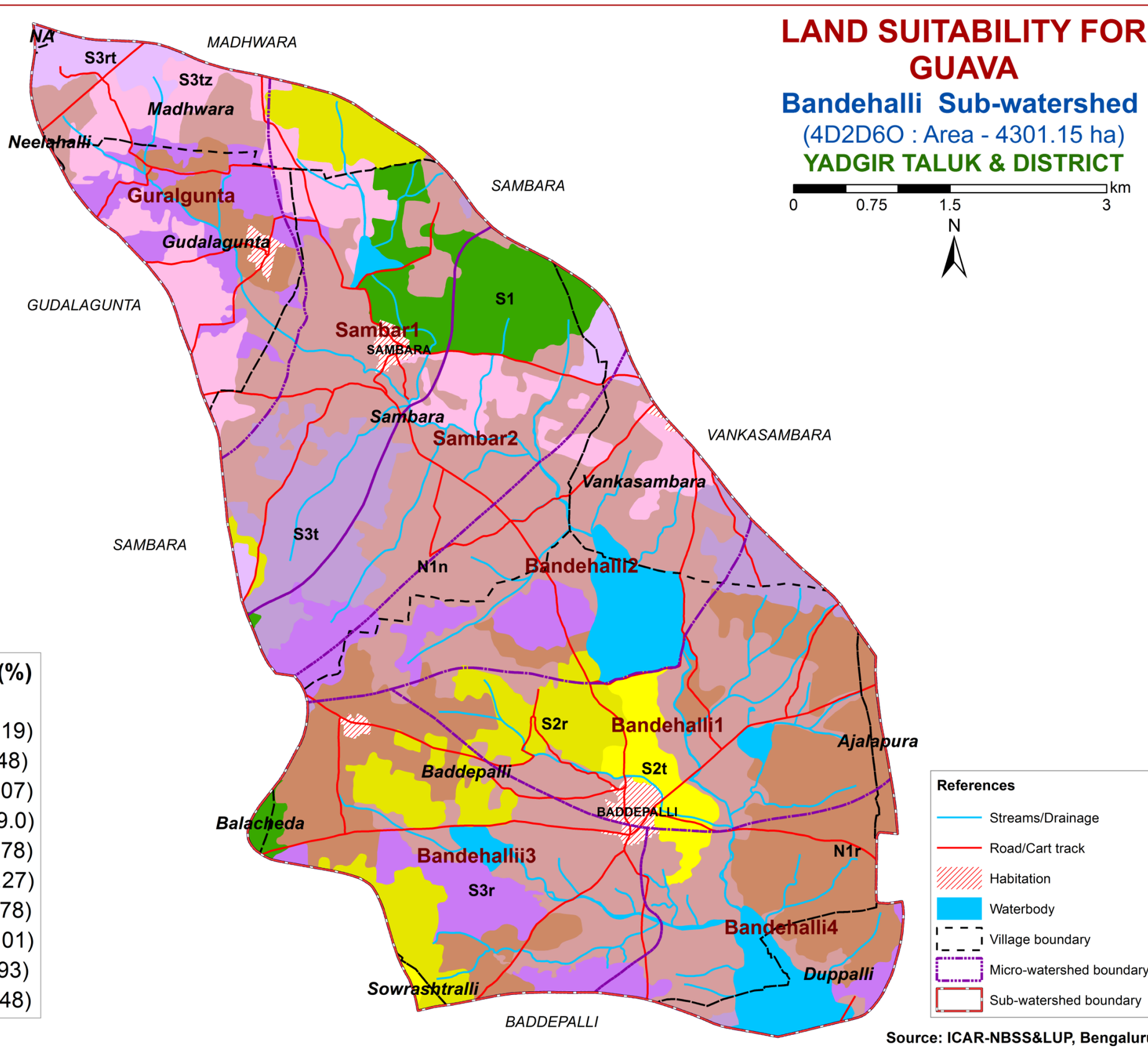
N

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.15. Land Suitability for Guava





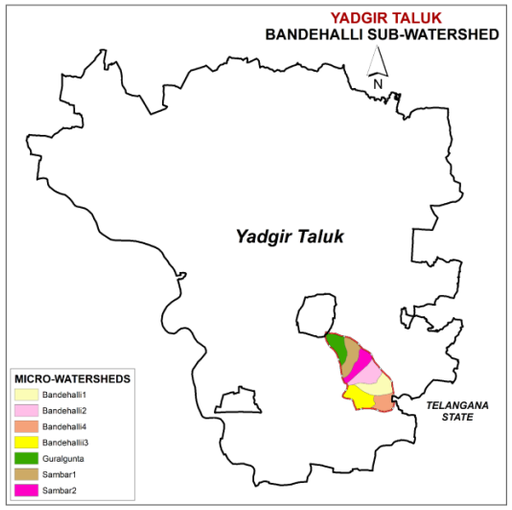
Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

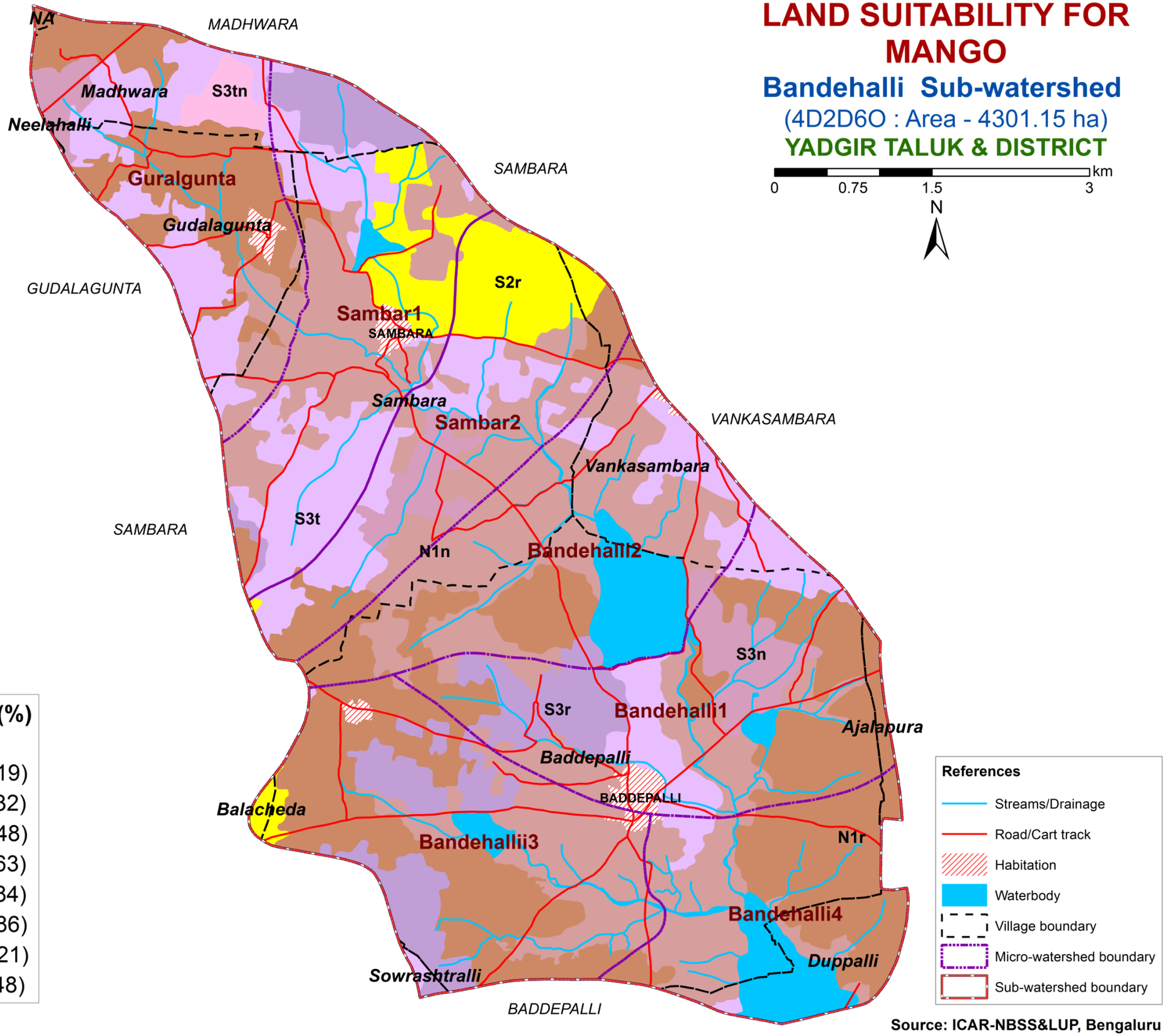
Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	223 (5.19)
S2r	322 (7.48)
S2t	89 (2.07)
S3r	387 (9.0)
S3t	292 (6.78)
S3rt	98 (2.27)
S3tz	377 (8.78)
N1n	1506 (35.01)
N1r	728 (16.93)
Others*	279 (6.48)

* - Habitation & Waterbody

7.16. Land Suitability for Mango





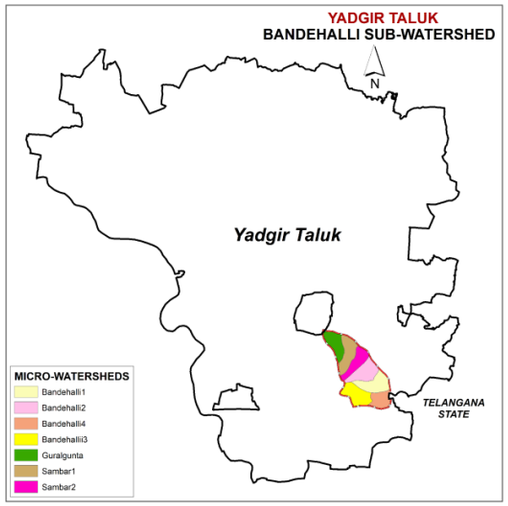
Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

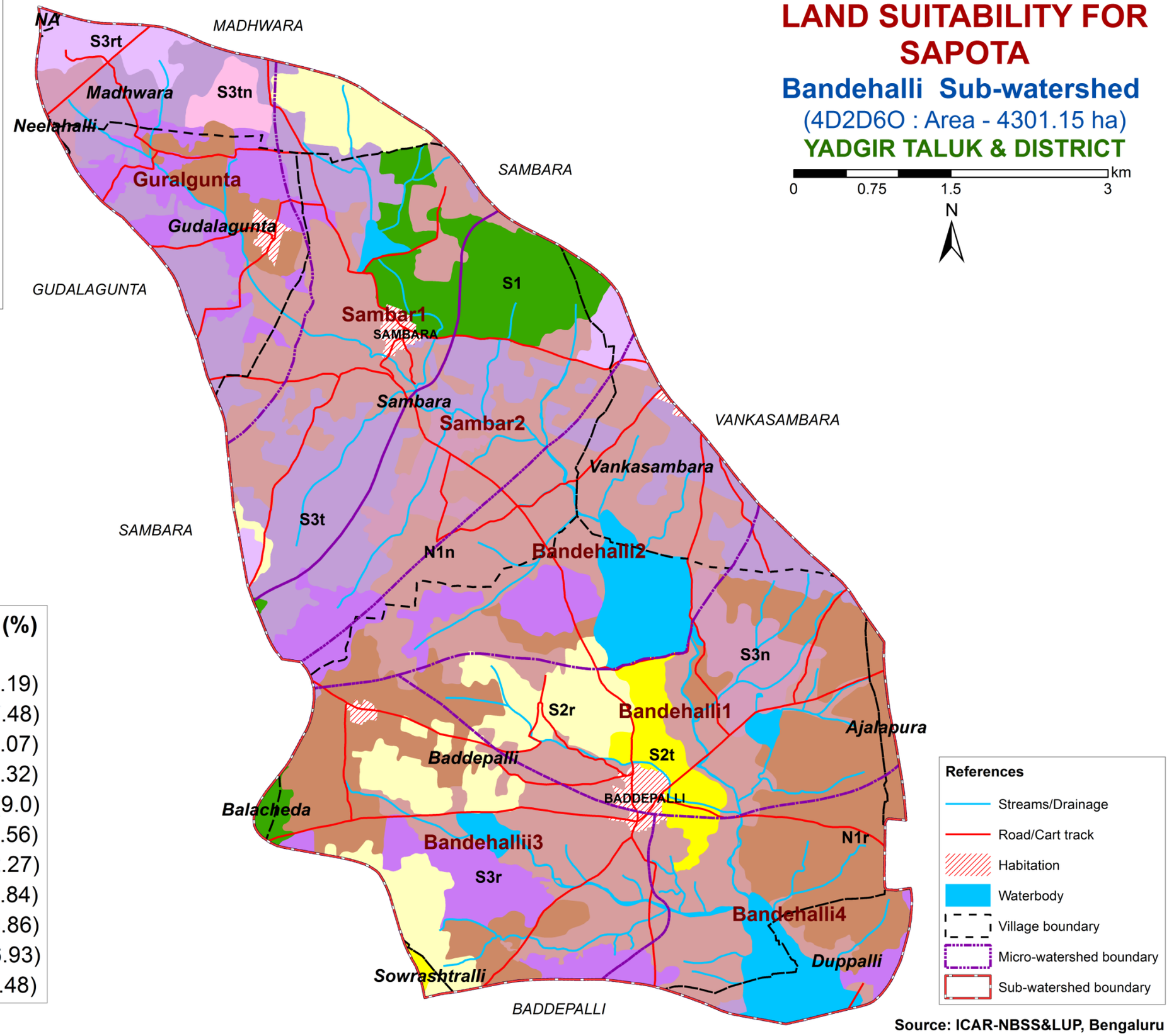
Limitations
n- nutrient availability
r- rooting condition
t- texture

Suitability subclass	Area in ha (%)
S2r	223 (5.19)
S3n	186 (4.32)
S3r	322 (7.48)
S3t	758 (17.63)
S3tn	36 (0.84)
N1n	1284 (29.86)
N1r	1213 (28.21)
Others*	279 (6.48)

* - Habitation & Waterbody

7.17. Land Suitability for Sapota





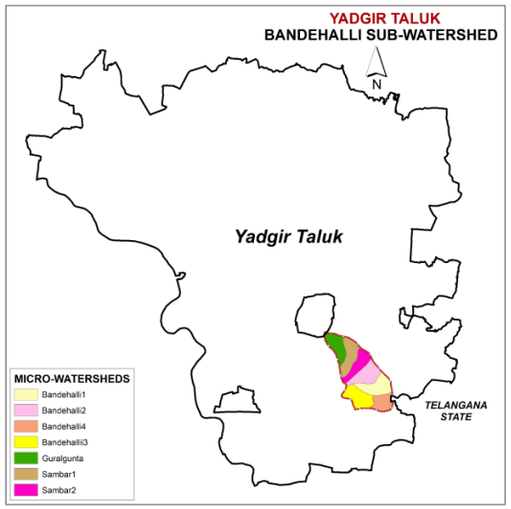
Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

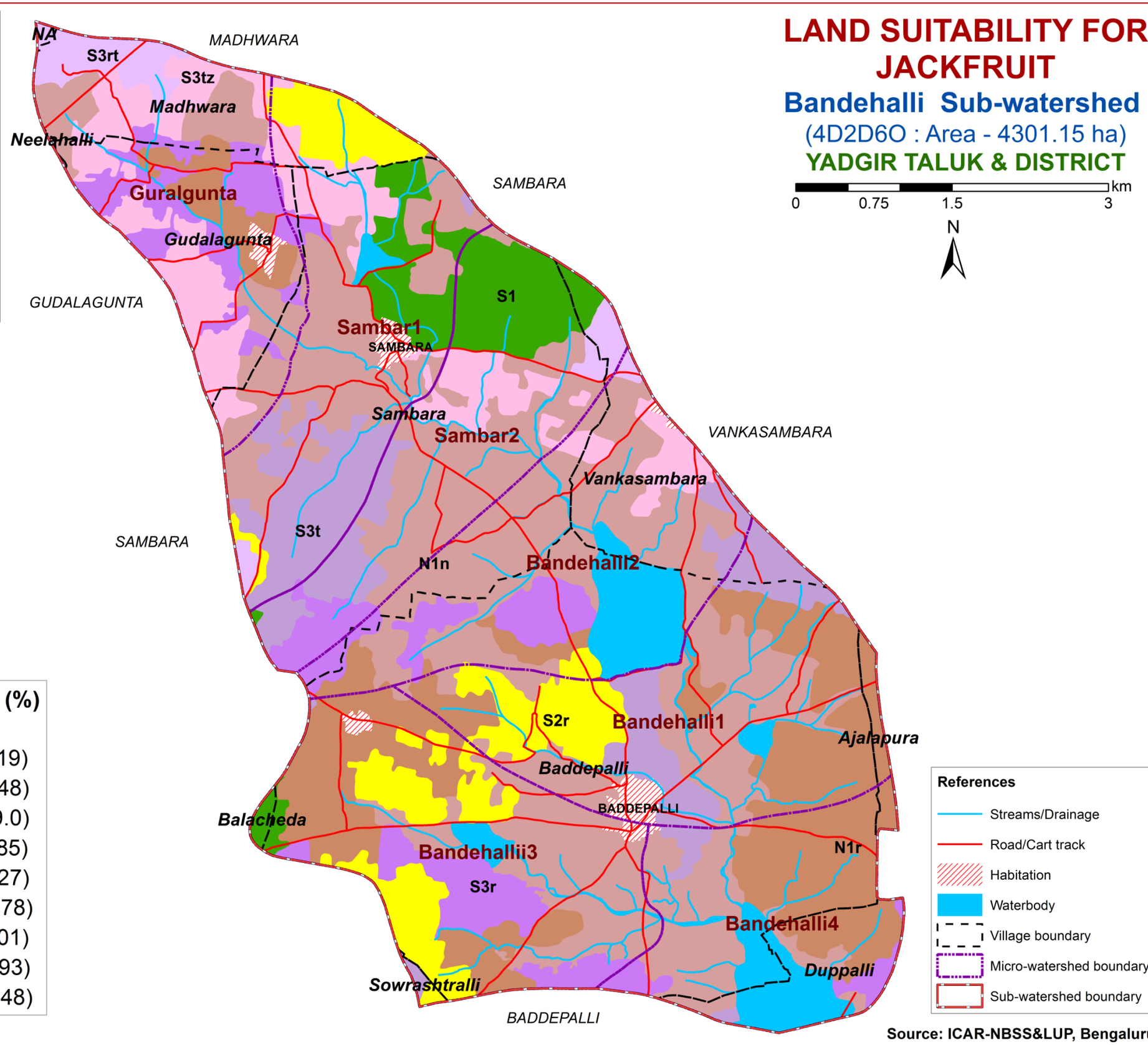
Limitations
n- nutrient availability
r- rooting condition
t- texture

Suitability subclass	Area in ha (%)
S1	223 (5.19)
S2r	322 (7.48)
S2t	89 (2.07)
S3n	186 (4.32)
S3r	387 (9.0)
S3t	669 (15.56)
S3rt	98 (2.27)
S3tn	36 (0.84)
N1n	1284 (29.86)
N1r	728 (16.93)
Others*	279 (6.48)

* - Habitation & Waterbody

7.18. Land Suitability for Jackfruit





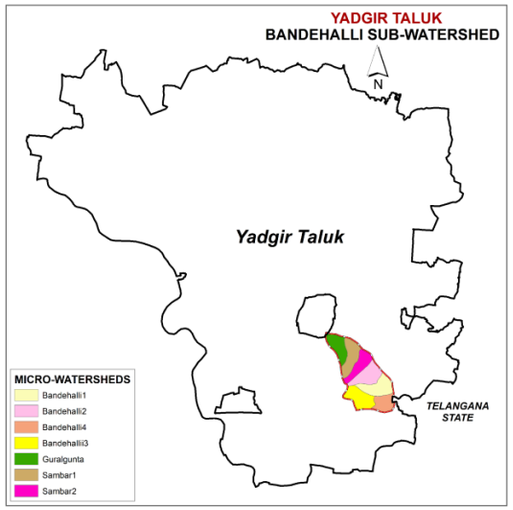
Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

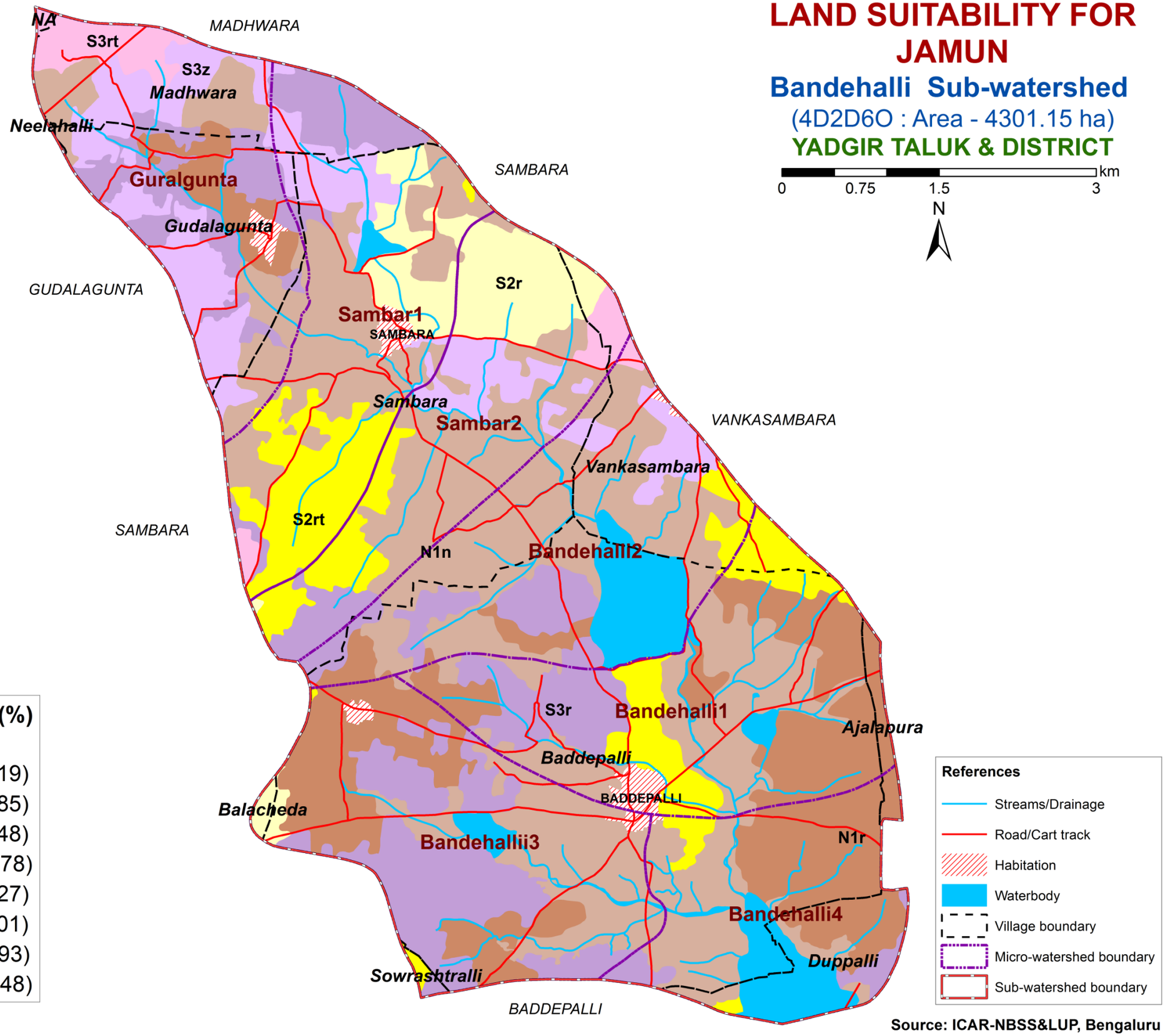
Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	223 (5.19)
S2r	322 (7.48)
S3r	387 (9.0)
S3t	381 (8.85)
S3rt	98 (2.27)
S3tz	377 (8.78)
N1n	1506 (35.01)
N1r	728 (16.93)
Others*	279 (6.48)

* - Habitation & Waterbody

7.19. Land Suitability for Jamun





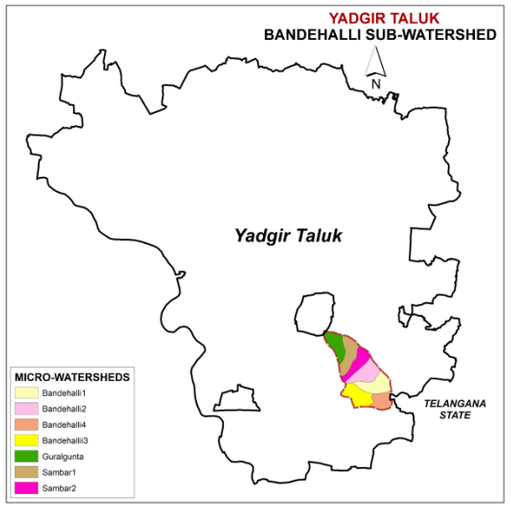
Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

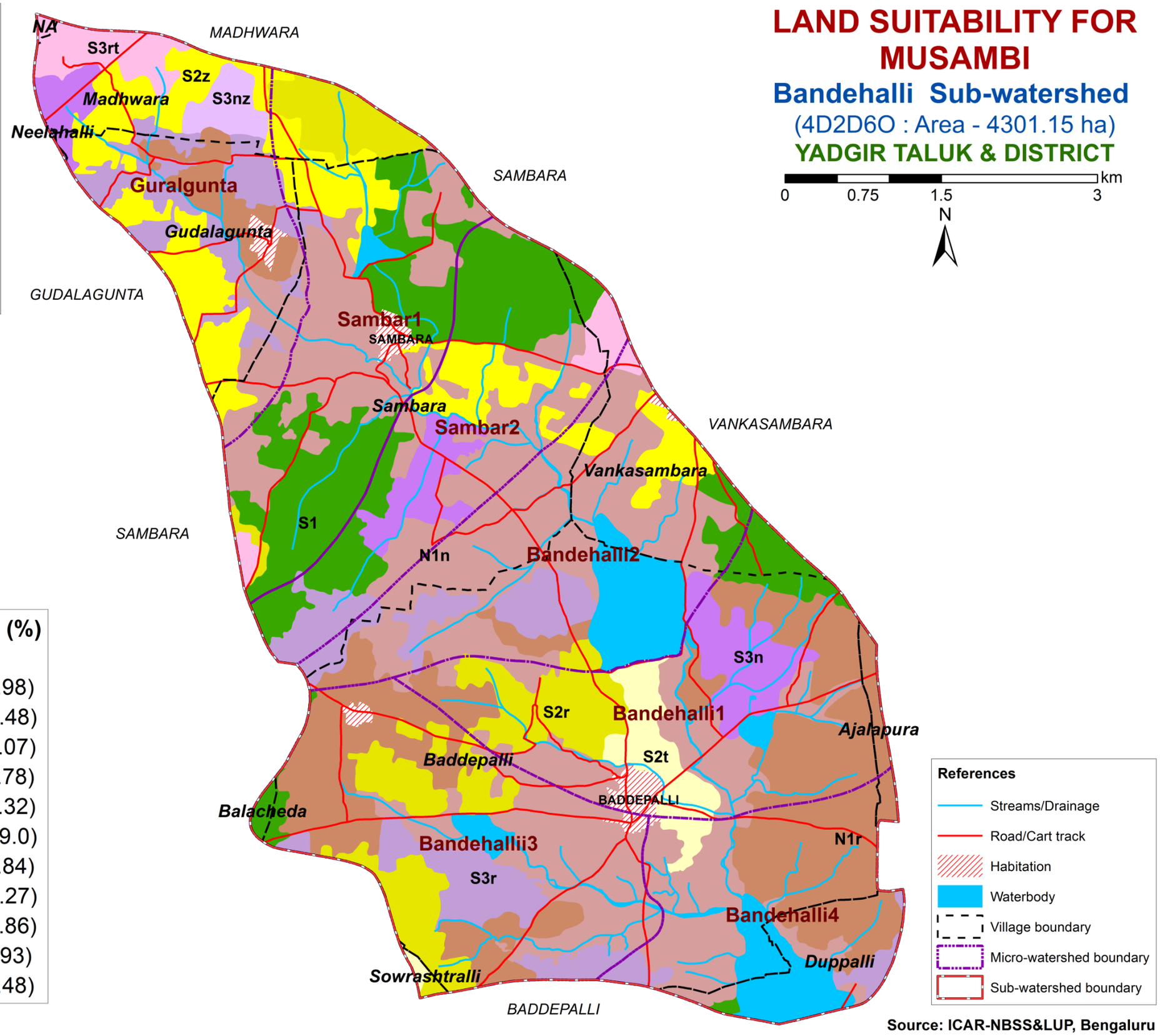
Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S2r	223 (5.19)
S2rt	381 (8.85)
S3r	709 (16.48)
S3z	377 (8.78)
S3rt	98 (2.27)
N1n	1506 (35.01)
N1r	728 (16.93)
Others*	279 (6.48)

* - Habitation & Waterbody

7.20. Land Suitability for Musambi





LAND SUITABILITY FOR MUSAMBI

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

N

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

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

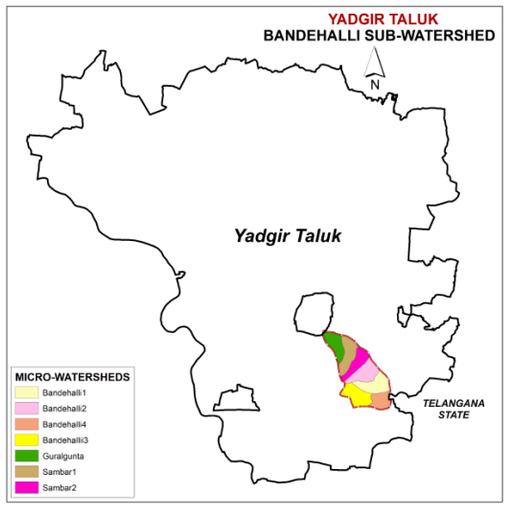
Suitability subclass	Area in ha (%)
S1	515 (11.98)
S2r	322 (7.48)
S2t	89 (2.07)
S2z	377 (8.78)
S3n	186 (4.32)
S3r	387 (9.0)
S3nz	36 (0.84)
S3rt	98 (2.27)
N1n	1284 (29.86)
N1r	728 (16.93)
Others*	279 (6.48)

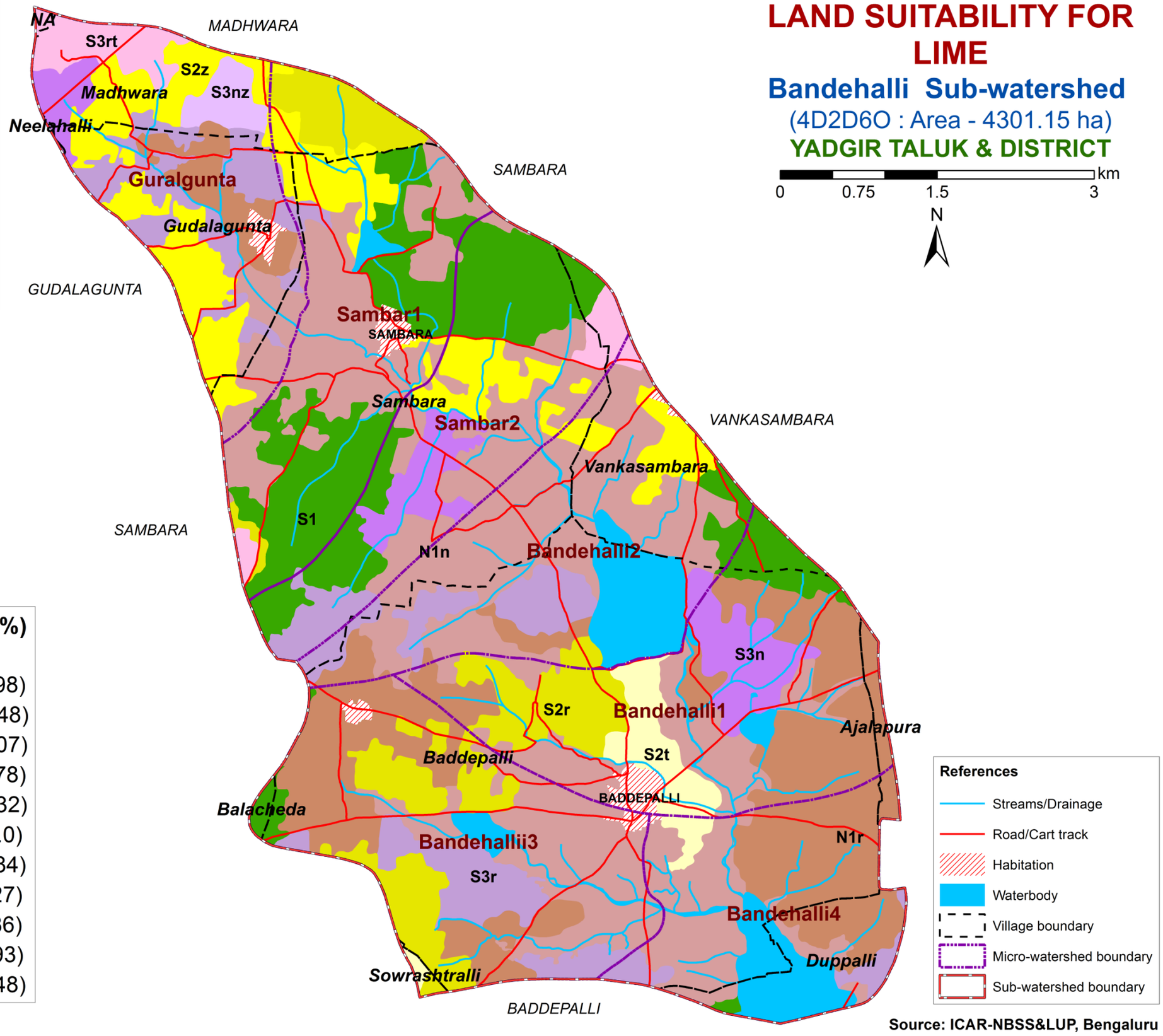
* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.21. Land Suitability for Lime





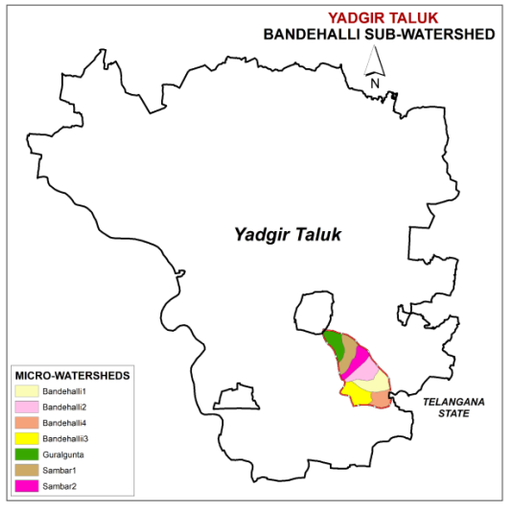
Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

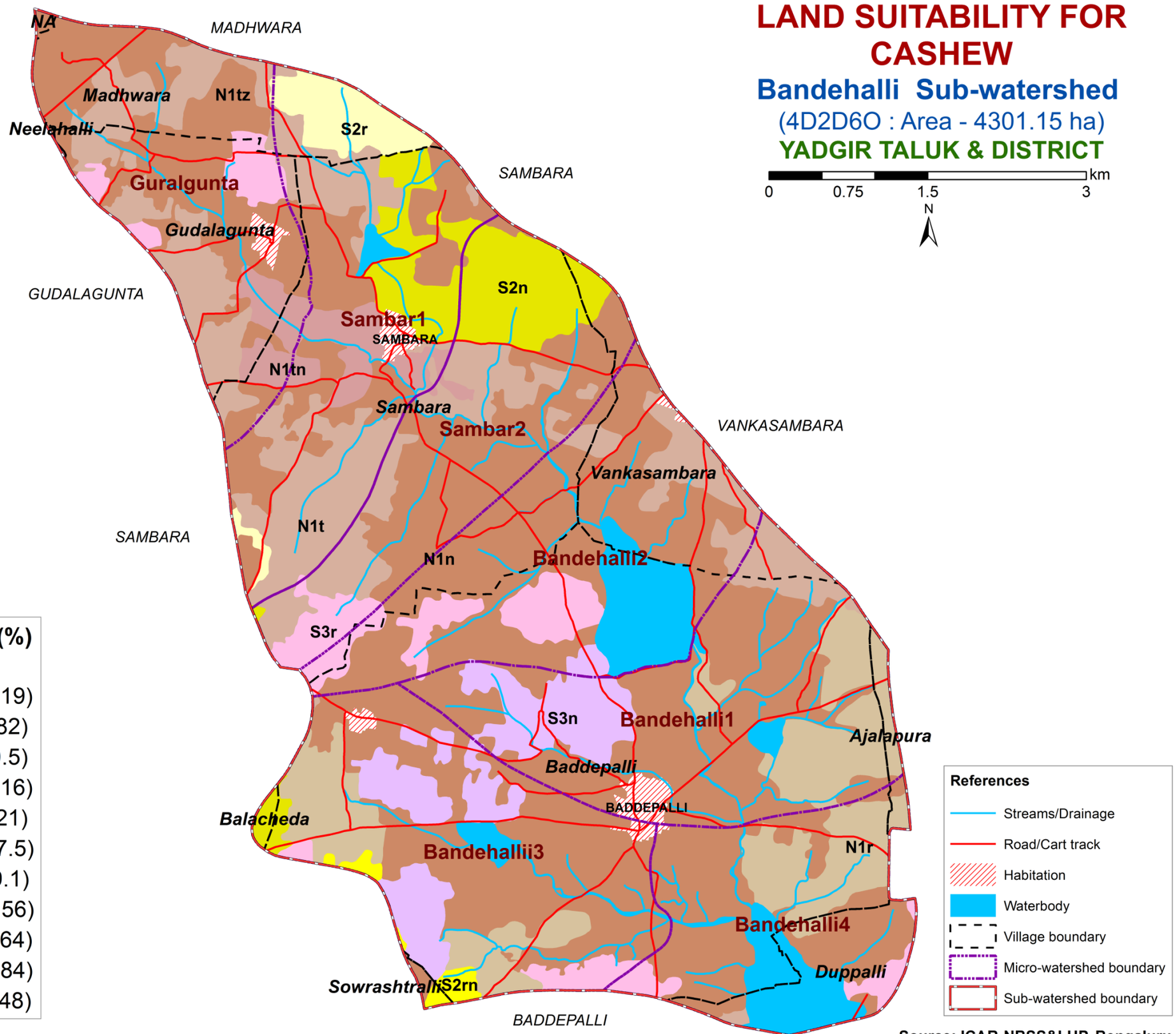
Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	515 (11.98)
S2r	322 (7.48)
S2t	89 (2.07)
S2z	377 (8.78)
S3n	186 (4.32)
S3r	387 (9.0)
S3nz	36 (0.84)
S3rt	98 (2.27)
N1n	1284 (29.86)
N1r	728 (16.93)
Others*	279 (6.48)

* - Habitation & Waterbody

7.22. Land Suitability for Cashew





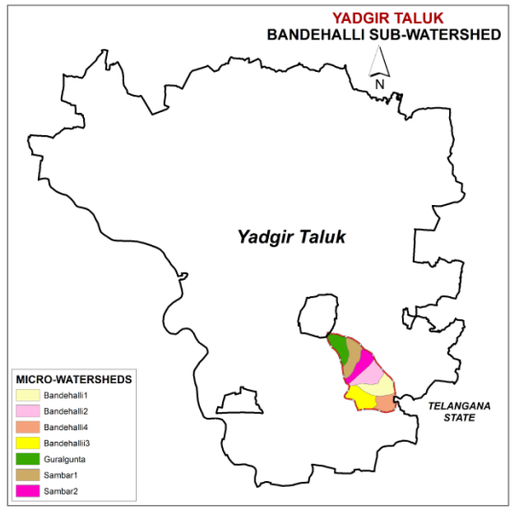
Key
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

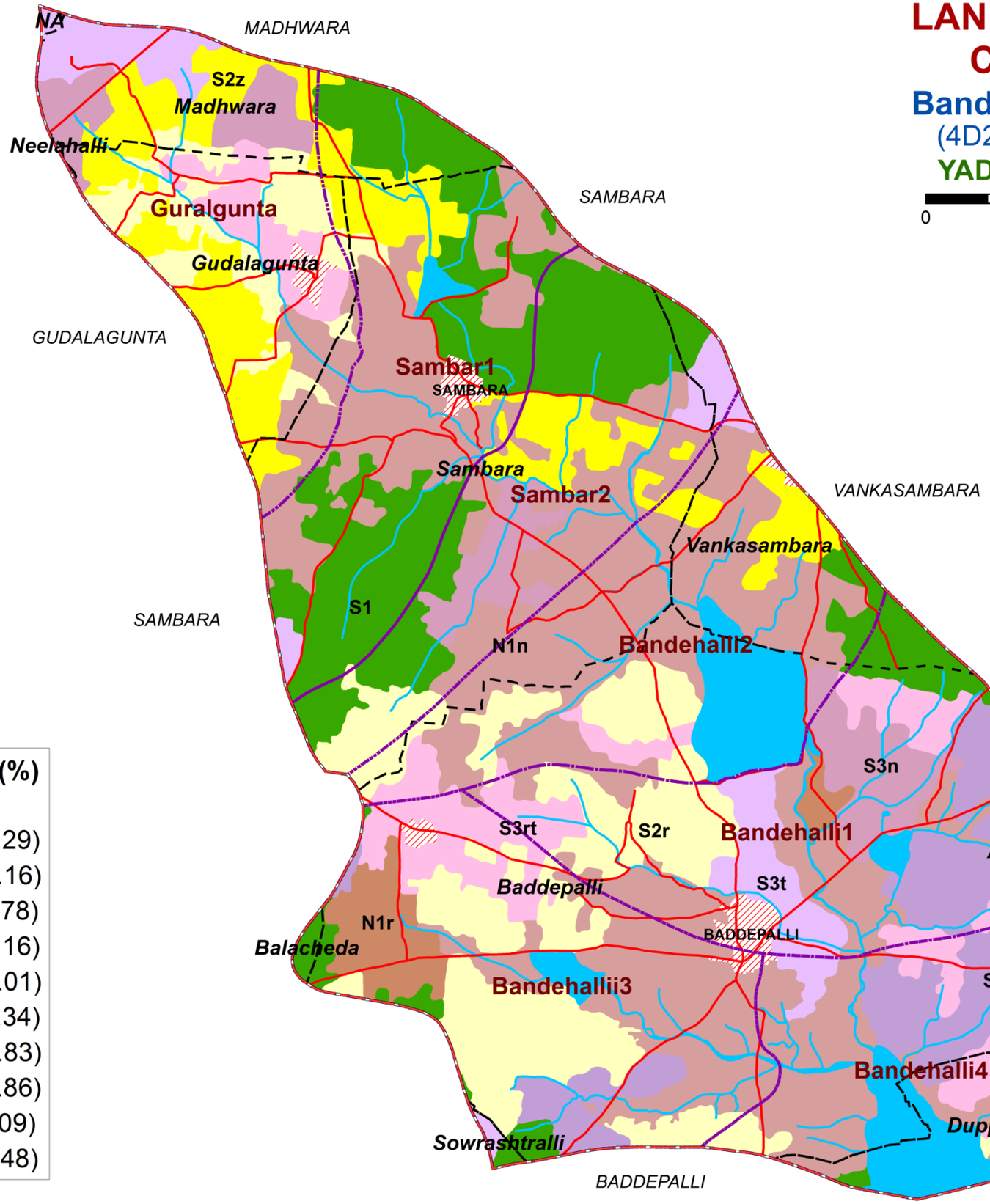
Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S2n	223 (5.19)
S2r	78 (1.82)
S2rn	22 (0.5)
S3n	222 (5.16)
S3r	224 (5.21)
N1n	2043 (47.5)
N1r	392 (9.1)
N1t	669 (15.56)
N1tn	113 (2.64)
N1tz	36 (0.84)
Others*	279 (6.48)

* - Habitation & Waterbody

7.23. Land Suitability for Custard Apple





LAND SUITABILITY FOR CUSTARD APPLE

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

N

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

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

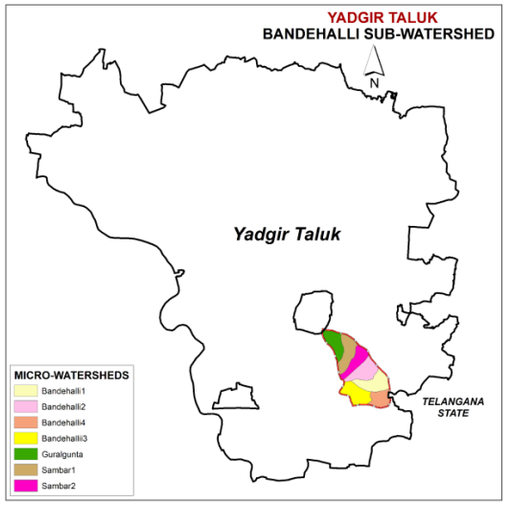
Suitability subclass	Area in ha (%)
S1	615 (14.29)
S2r	609 (14.16)
S2z	377 (8.78)
S3n	222 (5.16)
S3r	301 (7.01)
S3t	187 (4.34)
S3rt	337 (7.83)
N1n	1284 (29.86)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.24. Land Suitability for Amla



LAND SUITABILITY FOR AMLA

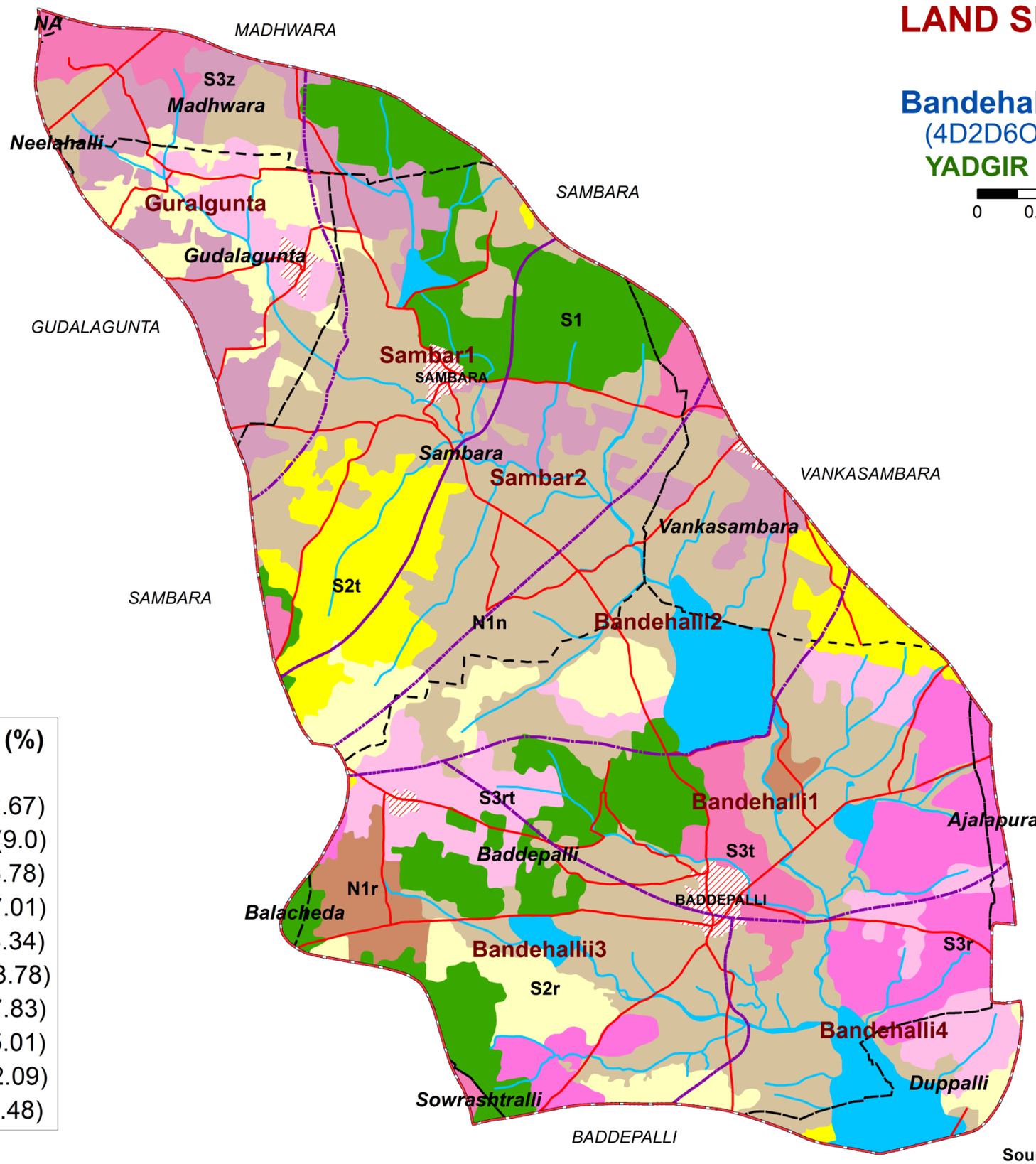
Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.5 1 2 km

N



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

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

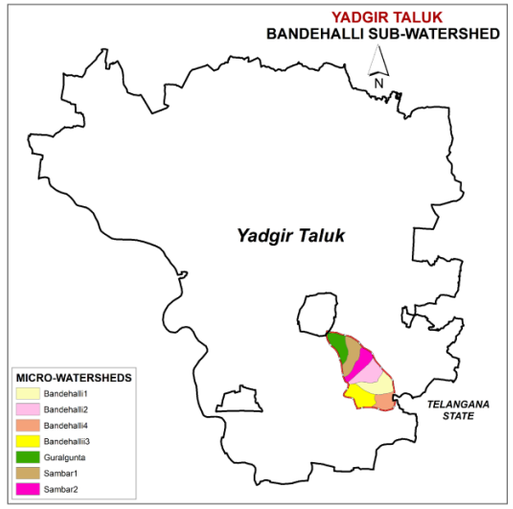
Suitability subclass	Area in ha (%)
S1	545 (12.67)
S2r	387 (9.0)
S2t	292 (6.78)
S3r	301 (7.01)
S3t	187 (4.34)
S3z	377 (8.78)
S3rt	337 (7.83)
N1n	1506 (35.01)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.25. Land Suitability for Tamarind



LAND SUITABILITY FOR TAMARIND

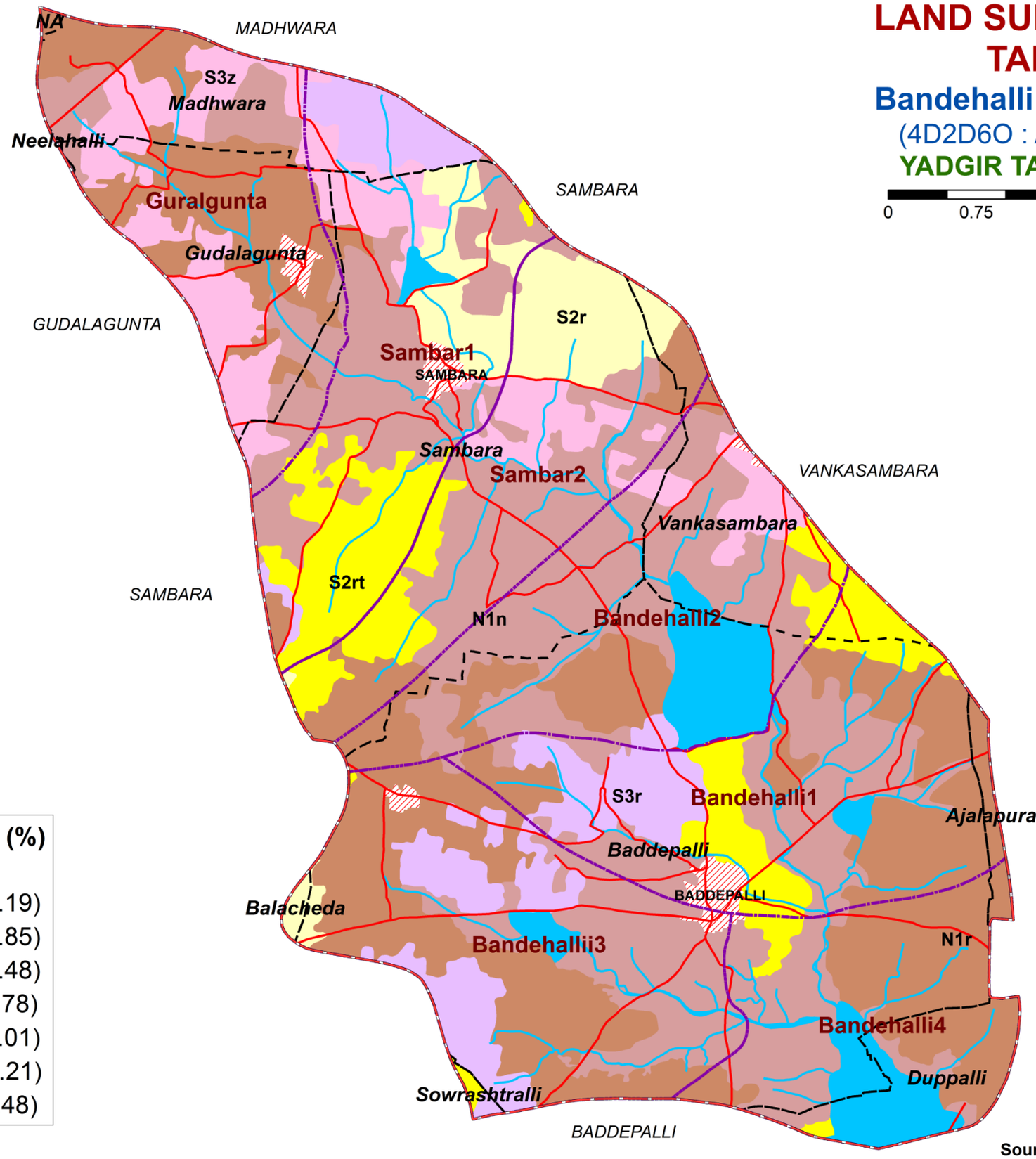
Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

N



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

Limitations
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

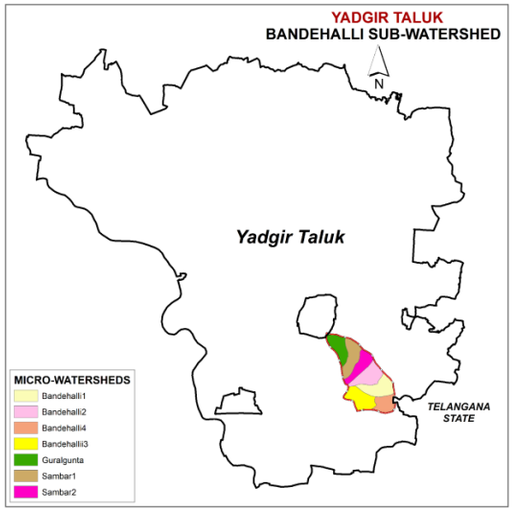
Suitability subclass	Area in ha (%)
S2r	223 (5.19)
S2rt	381 (8.85)
S3r	322 (7.48)
S3z	377 (8.78)
N1n	1506 (35.01)
N1r	1213 (28.21)
Others*	279 (6.48)

* - Habitation & Waterbody

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.26. Land Suitability for Brinjal

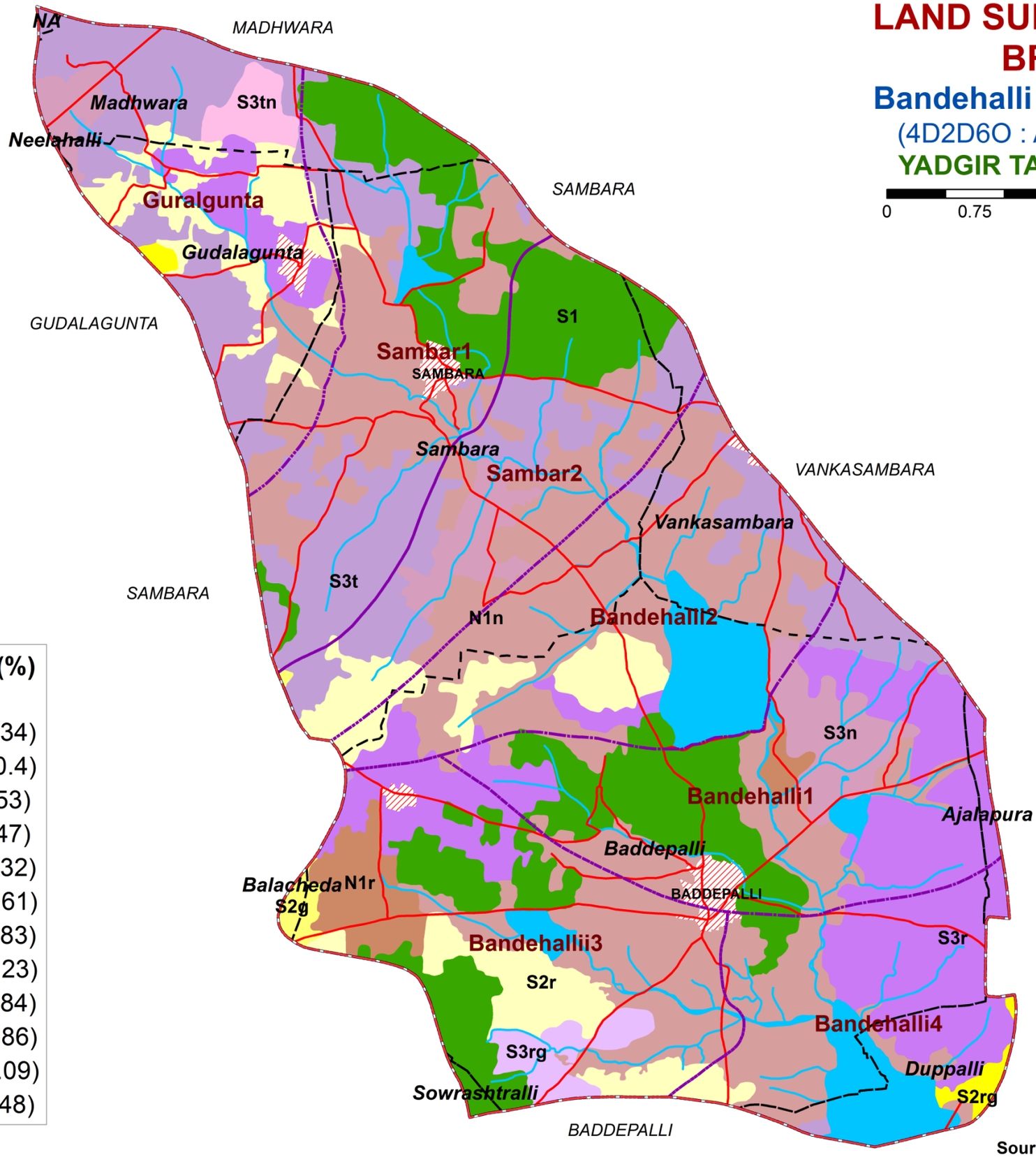


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture

Suitability subclass	Area in ha (%)
S1	617 (14.34)
S2g	17 (0.4)
S2r	367 (8.53)
S2rg	20 (0.47)
S3n	186 (4.32)
S3r	585 (13.61)
S3t	767 (17.83)
S3rg	53 (1.23)
S3tn	36 (0.84)
N1n	1284 (29.86)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody



LAND SUITABILITY FOR BRINJAL

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

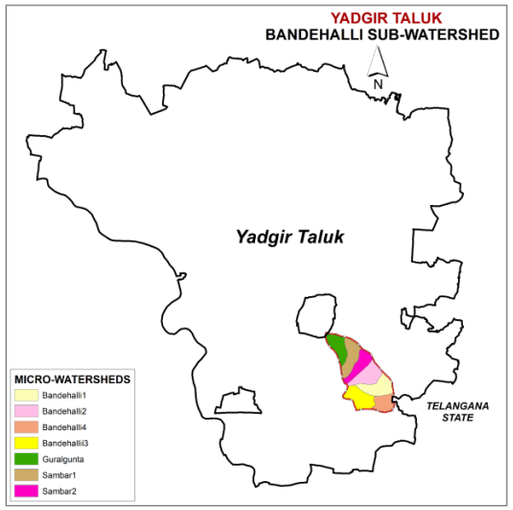
0 0.75 1.5 3 km

N

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.27. Land Suitability for Onion

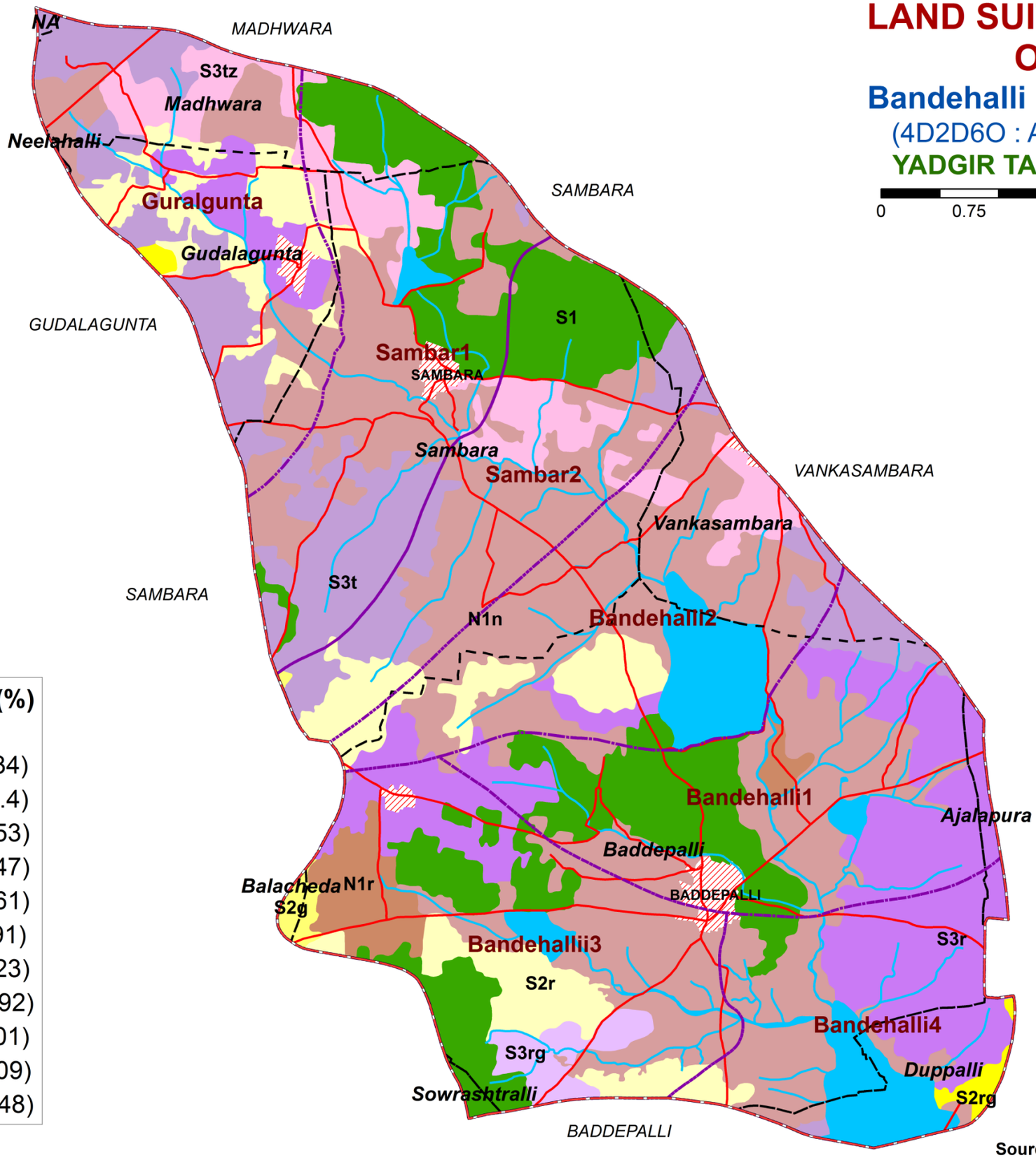


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

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

Suitability subclass	Area in ha (%)
S1	617 (14.34)
S2g	17 (0.4)
S2r	367 (8.53)
S2rg	20 (0.47)
S3r	585 (13.61)
S3t	512 (11.91)
S3rg	53 (1.23)
S3tz	255 (5.92)
N1n	1506 (35.01)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody



LAND SUITABILITY FOR ONION

Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

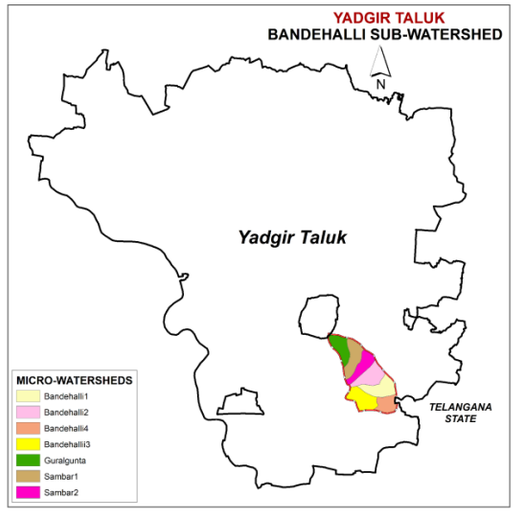
0 0.75 1.5 3 km

N

References
- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

7.28. Land Suitability for Marigold

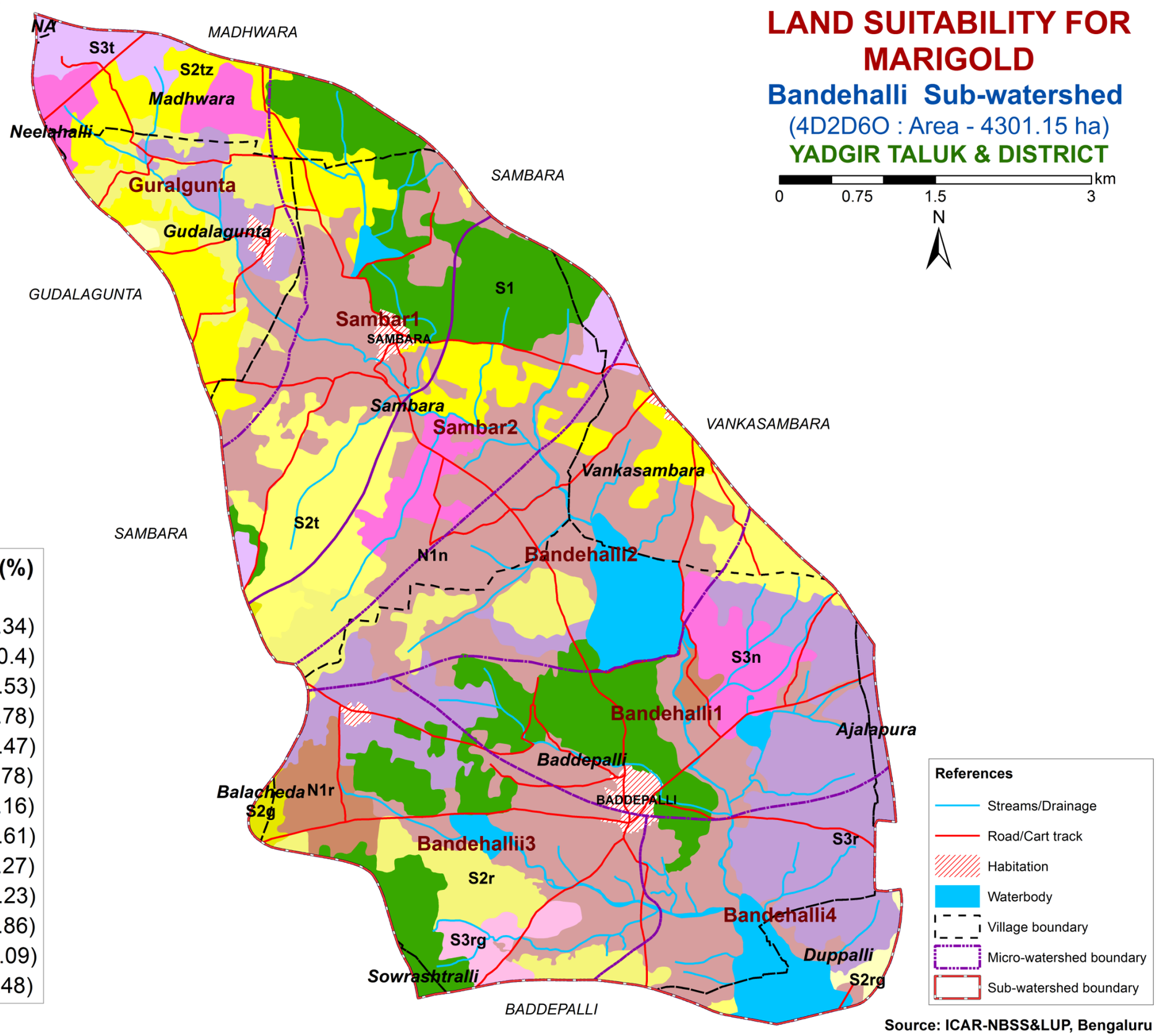


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

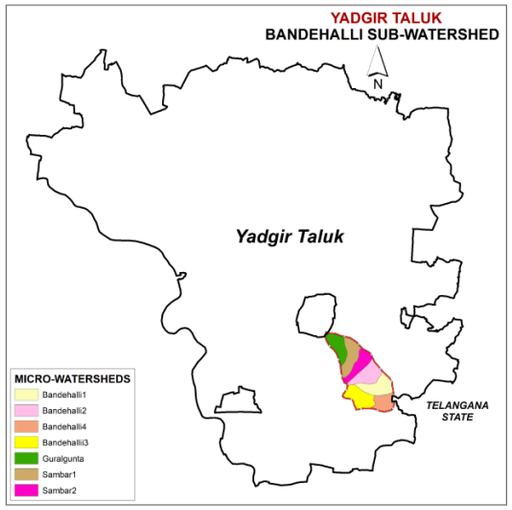
Limitations
g- gravelliness/stoniness
n- nutrient availability
r- rooting condition
t- texture
z- excess salt/calcareousness

Suitability subclass	Area in ha (%)
S1	617 (14.34)
S2g	17 (0.4)
S2r	367 (8.53)
S2t	292 (6.78)
S2rg	20 (0.47)
S2tz	377 (8.78)
S3n	222 (5.16)
S3r	585 (13.61)
S3t	98 (2.27)
S3rg	53 (1.23)
N1n	1284 (29.86)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody



7.29. Land Suitability for Chrysanthemum

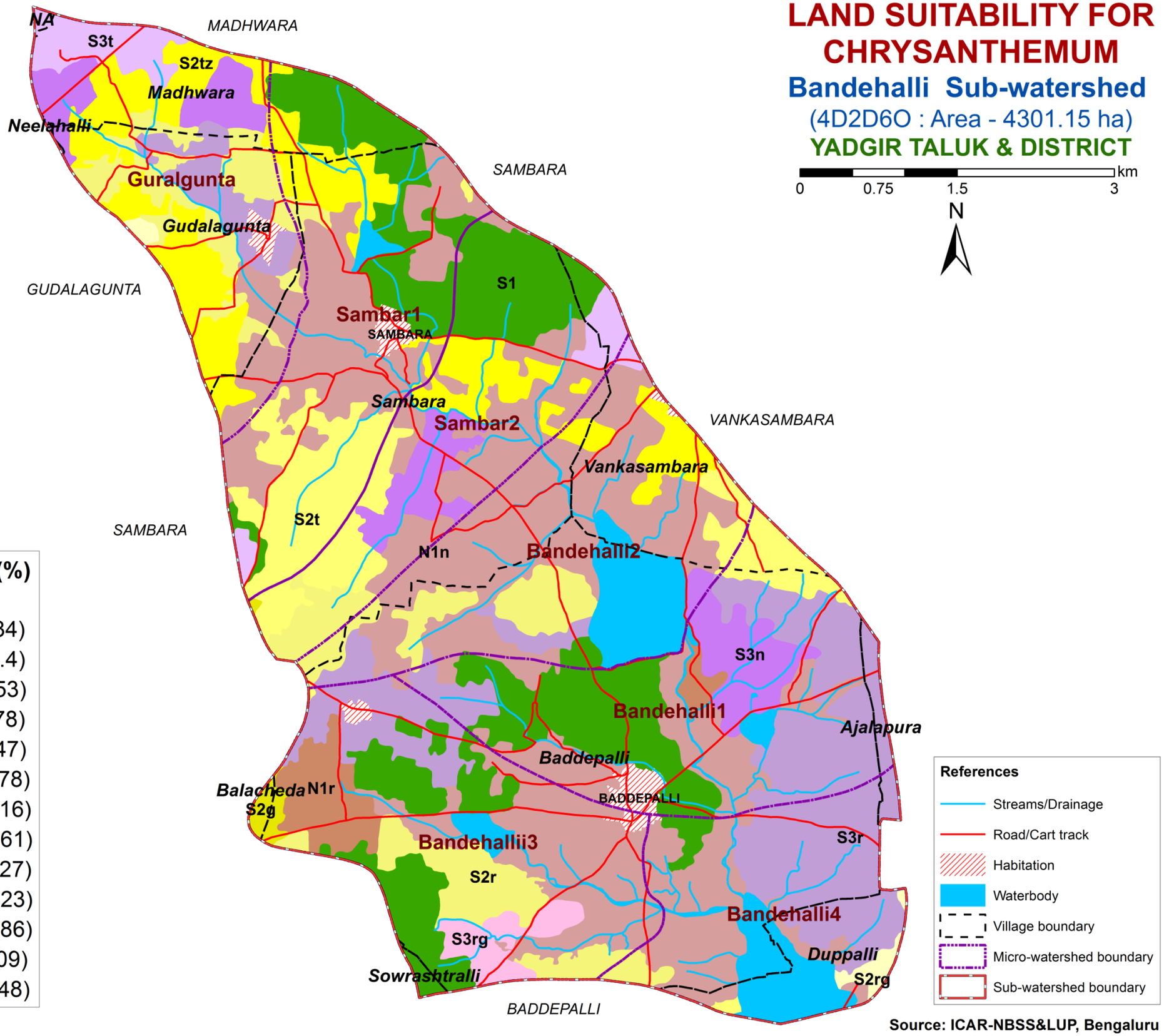


Key
S1- Highly Suitable
S2- Moderately Suitable
S3- Marginally Suitable
N1- Currently Not Suitable

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

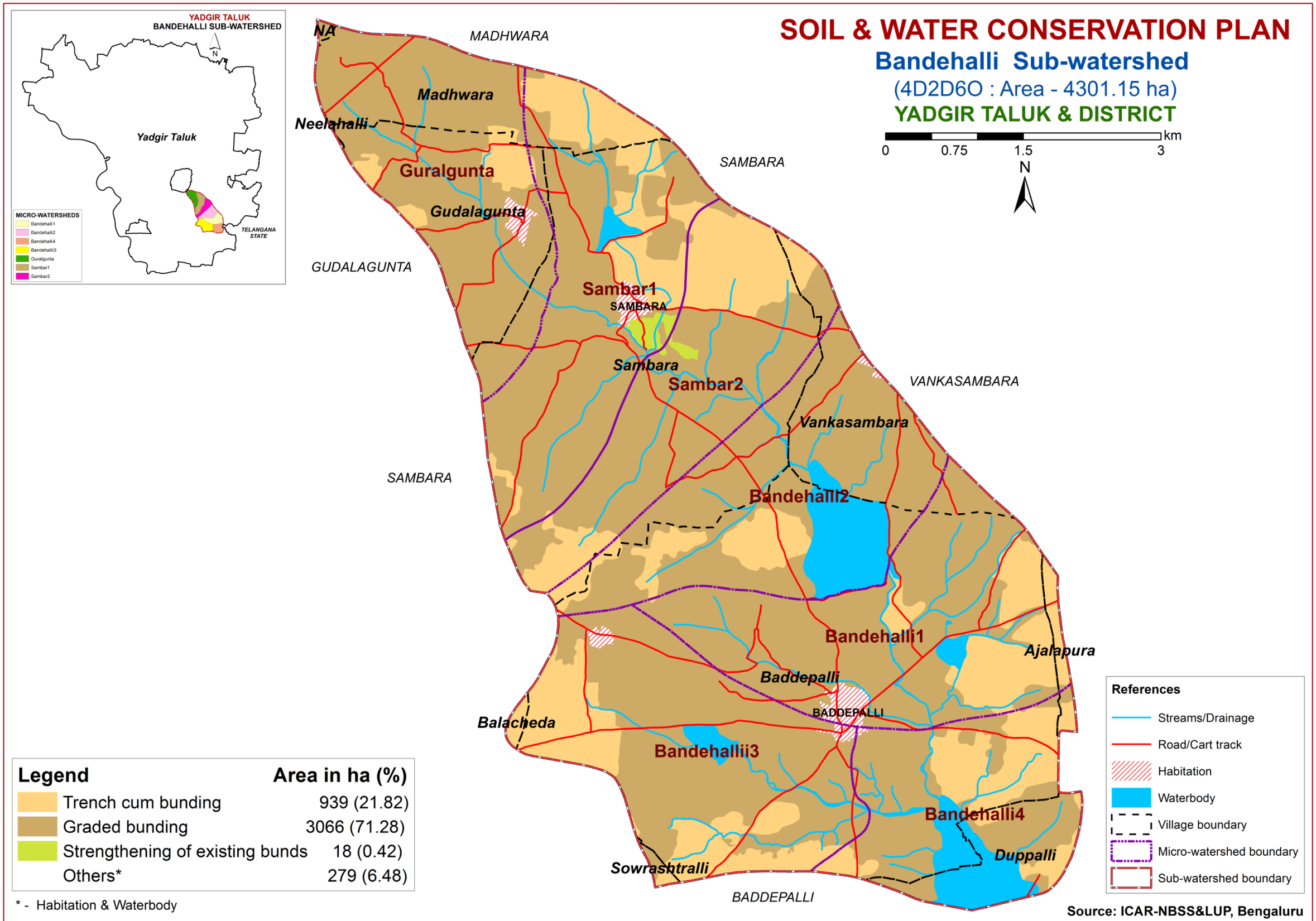
Suitability subclass	Area in ha (%)
S1	617 (14.34)
S2g	17 (0.4)
S2r	367 (8.53)
S2t	292 (6.78)
S2rg	20 (0.47)
S2tz	377 (8.78)
S3n	222 (5.16)
S3r	585 (13.61)
S3t	98 (2.27)
S3rg	53 (1.23)
N1n	1284 (29.86)
N1r	90 (2.09)
Others*	279 (6.48)

* - Habitation & Waterbody

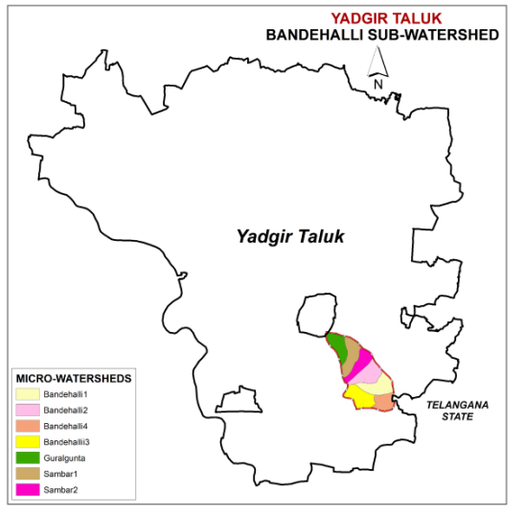


8. Soil and Water Conservation Measures

8.1. Soil & Water Conservation Plan



9. Land Management Units



LAND MANAGEMENT UNITS

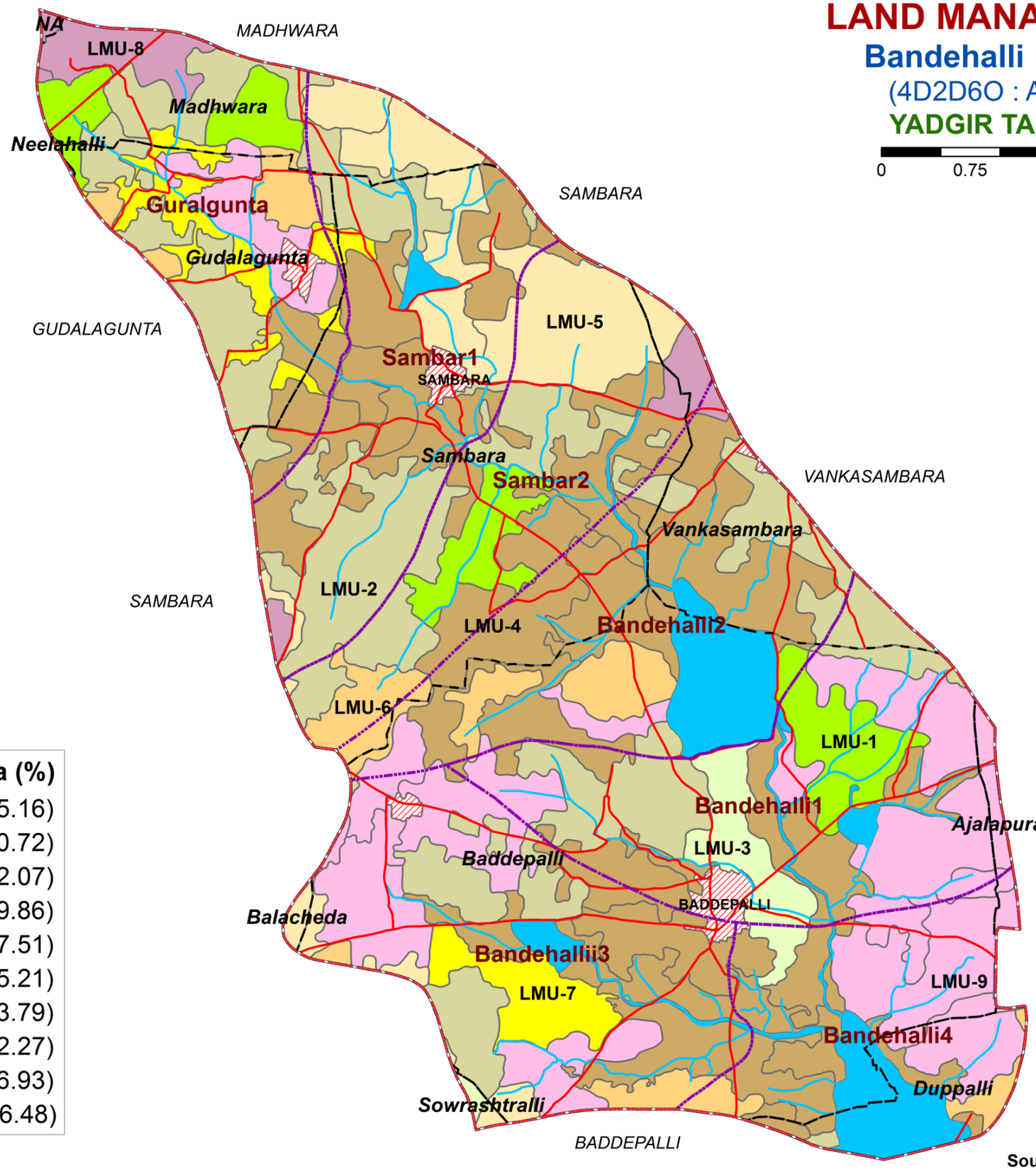
Bandehalli Sub-watershed

(4D2D6O : Area - 4301.15 ha)

YADGIR TALUK & DISTRICT

0 0.75 1.5 3 km

N



LMU	Area in ha (%)
LMU-1	222 (5.16)
LMU-2	891 (20.72)
LMU-3	89 (2.07)
LMU-4	1284 (29.86)
LMU-5	323 (7.51)
LMU-6	224 (5.21)
LMU-7	163 (3.79)
LMU-8	98 (2.27)
LMU-9	728 (16.93)
Others*	279 (6.48)

* - Habitation & Waterbody

References

- Streams/Drainage
- Road/Cart track
- Habitation
- Waterbody
- Village boundary
- Micro-watershed boundary
- Sub-watershed boundary

Source: ICAR-NBSS&LUP, Bengaluru

NOTE: *Proposed Crop Plan for LMUs are given in Table*

10. Table. Proposed Crop Plan for Bandehalli Sub-watershed, Yadgir Hobli, Yadgir Taluk, Yadgir 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	59.MDRcB2 61.MDRmB2 84.KDRcB2 148.MDGhB2 (Deep to very deep, strongly alkaline soils)	**Baddepalli:** 129,136,137,138,139,140,141,142, 180,181, 182,183,184,185,186, 200,202(1),202(2) **Gudalagunta:** 87 **Madhwara :** 27,28,29,30,570,571,572,573,574,575,576,585,586 **Neelahalli :** 262,263,264 **Sambara:** 127,128,135,136,137,138,173,174, 175,206	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
2	47.NGPbB2 49.NGPmB2 50.BGDbB2 62.BMNmB2 111.HSLbB2 126.HSLhB2 (Moderately deep to deep, black calcareous clay soils)	**Baddepalli :** 109,110(1),132,192,193(1),193(2),410(1),413,414, 415,416,417,426,427,428,429,442,449,450,451,467, 470,471,474,475,478,480,481,482,486,487,517,525, 526,535,536,537,538,539,575,577,578,579 ,580,581,582 **Duppalli :** 422 **Gudalagunta :** 2,28,29,30,31,34,35,36,37,39,48,49,50,51,52,53,54, 55,56,78,86,88,89,90,95,97,98 **Madhwara :** 549,550,551,553,568/1,569,577,578,579,581,582, 583,584,587,591,592, 593,594,595,596 **Sambara :** 101,102,106,107,108,110,111/1,120,122,125,126, 176,177,179,191,194,20,200,202,203,204,205,207, 208,210,211,212,22,220,221,222/3,225,,227,228,229 ,23,230,231,233,234,24,,30/2,301,316,317,319,321, 323,324,325,326,327,328,33,45,46,47,48,49,,50,51, 52,54,55,56/1,56/2,57,58,59,60,61,62,63,64,65,66/2, 79,80,81,82/1,82/2,82/3,83/1,83/2,84,85,86,87,88/1 ,88/2,89 **Vankasambara :** 105,108,109,110,111,112,113,114,115,116,118,139, 141,142,143,144,145, 146,153,16,162,22,23,24, 25	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

To be continued….

LMU. No	Soil Map Units	Survey Number	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
3	101.NHLmB1 (Deep, lowland sandy loam soils)	**Baddepalli :** 583 **Sowrashtralli:** 55,72,74	Red gram, Groundnut, Bajra, Horse gram, Field bean, Soybean	**Fruit crops:** Sapota, Jamun, Guava, Tamarind, lime, Musambi, Pomegranate **Vegetables:** Onion, Chilli, Brinjal, Tomato, Bhendi, Drumstick, Coriander **Flowers:** Marigold, Chrysanthemum	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
4	34.GWDcB2 35.GWDiB2 42.YDRcB2 103.TMKhA1 104.TMKiB2 117.VKSiB2 (Sodic soils)	**Baddepalli :** 113,115,116,117,118,164,165,179,201,203,204,205,207,210,300,326,333,334,335,336,337,338,341(1),341(2),345,346,347,348,349,350,351,352,357,370,371,374,375,376,377,378,379,380,381,382,383,384,385,386,387,388,389,390,400(1),400(2),423,444,445,446,447,448,479,483,484,485,488,489,490,491,492,493(1),493(2),494,495,496,500,501,540,549,551,552,554,555,558,559,560,561,562,564, 565,573,574,576,589 **Duppalli :** 321,423,424,452,453 **Gudalagunta :** 22,23,25,26,33,5,6,7 **Madhwara :** 465 **Sambara :** 10,100,103,104,105,109,11,111/2,112,113,114,115,116,117,118,119,12,121,123,124,129,13,130,131,132,133,134,139,14,140,141,142,143,144,145,146,147,148,149,15,150,151,152,153,154,155,156,157,158,159,16,160/1,160/2,161,162,163,164,165,166,167,168,169,17,170,171,172,178,18,180,181,182,183,184,185,186,187,19,192,195,196,197,198,199,201,209,21,213/1,213/2,214,215,216,217,218,219,222/1,222/2,223,224,226,232,235,236,237,25,26,27,28/1,283,29,291,292,293,296,30/1,30/3,302,304,305,306,308,309,31,312,313,314,315,318,329,330,331,332,333,334,335,336,337,338,339,340,341,342,343/1,343/2,343/3,343/4,344/1,345/1,345/2,345/3,345/4,346/1,346/2,346/3,347,348,349,350,351/1,351/2,351/3,352/1,352/2,352/3,353,354,5,53,6,7,77,78,8,9,90,91,92,93,94,95,96,97,98,99 **Vankasambara :** 117,119,120,121,122,123,124,125,126,127,128,129,130,131,132,133,134,135,136,137,138,140,154,155,156,157,158,159,160,161, 163,164,165,166		**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	Survey Number	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
5	37.BLCcB2 40.PGPcB2 41.PGPiB2 44.GDGbB2 45.GDGbB3g1 46.GDGiB2 (Moderately deep to deep, red sandy clay to sandy clay loam soils)	**Baddepalli:** 408,409,436,437,440,456 **Balacheda:** 169,170,171,172 **Madhwara :** 472,473,474,475,476,477,478,479,480,481,482, 542,544,545,546,547, 548,552,554 **Sambara :** 239,240,241,242,243,244,245,246,247,248,249, 250,251,252,253,254,255,256,257,258,259,265, 266/1,266/2,267,268,269,270,271,272,273,274, 275,276,277,278,279,280,281,282,284,285,286, 287,288,289,290,294,295,303,307,310,32/2,320 ,322,35,44,66/1 **Sowrashtralli :** 75,76,77 **Vankasambara :** 177,178,194,195,204	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
6	25.DPLcB2 27.YLRbB2 29.YLRcB2g1 31.YLRiB2 (Moderately shallow, sandy clay to clay soils)	**Baddepalli :** 111,112,112,114,114 ,353,354,355,356,358,359,360,361,362,363,364 ,369,431,432,433,550,556,557,563,566, 567, 568,569,570,571 **Duppalli:** 300,307,312 **Gudalagunta:** 1,102,108,109,110,73,77,80,81,82,83,84,85, 96 **Sambara:** 68,69,70,71,72,73,74 ,75,76	Maize, sorghum Groundnut, Bajra, Cotton	**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

To be continued….

LMU. No	Soil Map Units	Survey Number	Field Crops/ Commercial crops	Horticulture Crops (Rainfed/Irrigated)	Suitable Interventions
7	20.JNKcB2 22.JNKiB2 (Moderately shallow, red sandy clay loam soils)	**Baddepalli :** 401,402,403,418,419 ,420,421,422,424,425,439, 441,443 **Gudalagunta :** 100,17,18,19,24,27,3, 32,4,79,92,93,94,99 **Sambara :** 336	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	1.SBRcB2 (Moderately shallow loamy sand soils)	**Madhwara:** 23,24,25,26,31,32,33, 34,35,36,580,588,589,590, 606,607 **Sambara :** 238,34,38 **Vankasambara :** 167,168,169,172,173, 174,175,176	-	**Agri-Silvi-Pasture:** Hybrid Napier, *Styloxanthes hamata, Styloxanthes scabra*	Application of FYM, Biofertilizers and micronutrients, drip irrigation, Mulching, suitable soil and water conservation practices
9	1.BDPiB2 2.BDLbB2 4.BDLhB2 5.BDLiB2 9.VNKcB2 10.VNKiB2 120.BDPhB2 121.DSBcB2 (Shallow soils)	**Ajalapura :** 140,157,158,161,162, 413,414 **Baddepalli :** 110(2),130,131,133,134,135,143,144,145,146,173, 187,188,189,190,191,194,195,196,197,198,199,206, 208,209,211,212,213,214,215,216,217,218,219,220, 221,222,223,224(1),224(2),225,226,227,228,229,23 0,231,232,233,234,235,236,237,238,239,240,241, 242,243,244,245,246,247,254,255,256,367,368,372, 373,404,405,406,407,410(2),411,412,434,435,438, 452,453,454,455,457,458,459,460,461,462,463,464, 465,466,468,469,472,473,476,477,527,528,529,530, 531,532,533,541,542,543,544,545,546,547,548,553, 572 **Duppalli:** 308,309,310,311,313,314,315,316,317,318,319, 320,322 **Gudalagunta :** 10,101,103,104,105,106,107,11,111,16,20,21,8,91 **TELANGANA:** 226,235,236,239,240,241,307,308	-	Hybrid Napier, *Styloxanthes hamata, Styloxanthes scabra*	Use of short duration varieties, sowing across the slope

PART-B

Hydrological Inventory of Bandehalli 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 Bandehalli 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

Phone:080-23412242

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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
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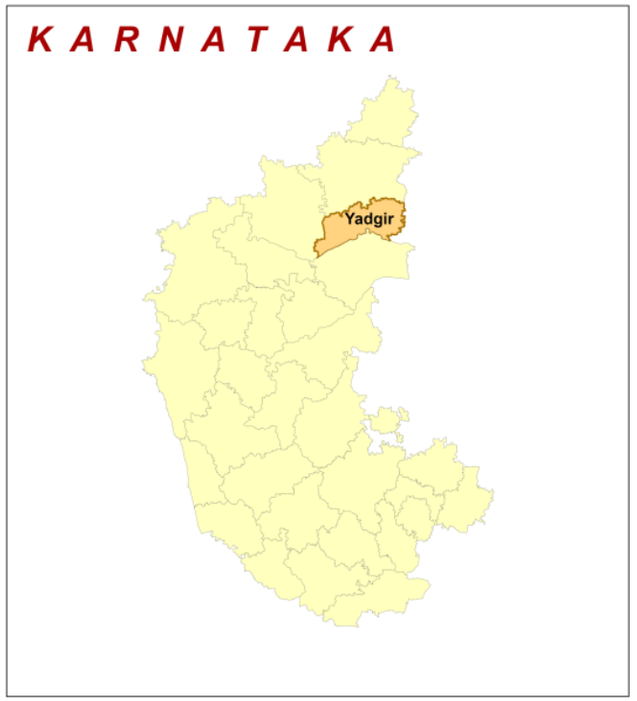
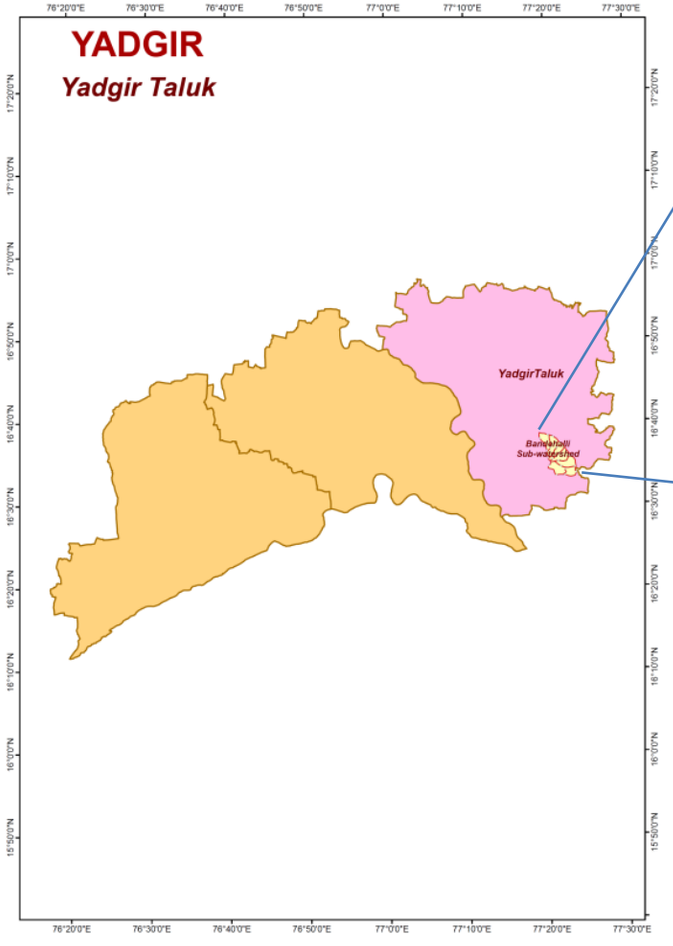
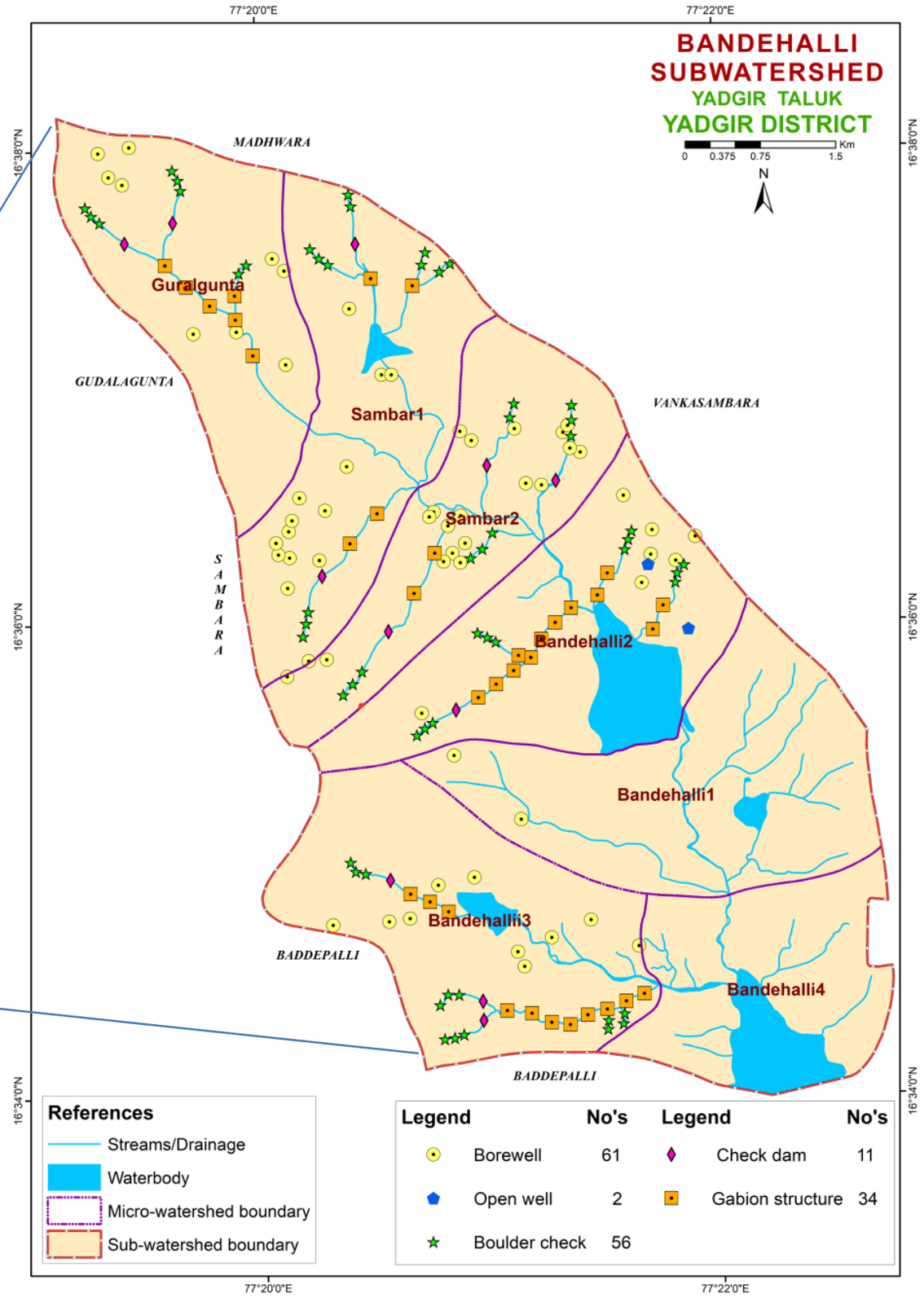
INTRODUCTION

- The inventory and documentation of spatial and temporal changes in hydrological components of Bandehalli sub-watershed (4D2D6O) in Yadgir taluk, Yadgir district, has been undertaken for integrated planning, development and management at the level of soil mapping units.
- Bandehalli sub-watershed (Yadgir taluk, Yadgir district) is located between 16^0 32’20’’–16^0 39’26’’ North latitudes and $77^0$18’28’’–76^0 24’6’’ East longitudes, covering an area of about 4293 ha.
- This sub-watershed encompasses of 7 MWs namely, Bandehalli-4 (4D2D6O2d), Bandehalli-3 (4D2D6O2c), Bandehalli-1 (4D2D6O2b), Bandehalli-2 (4D2D6O2a), Sambar-2 (4D2D6O1c), Sambar-1 (4D2D6O1b), Guralgunta (4D2D6O1a) micro watersheds. 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, Chilli, Soybean , Paddy and major *rabi* crops are Sorghum, Bengal gram and 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 BANDEHALLI SUB-WATERSHED

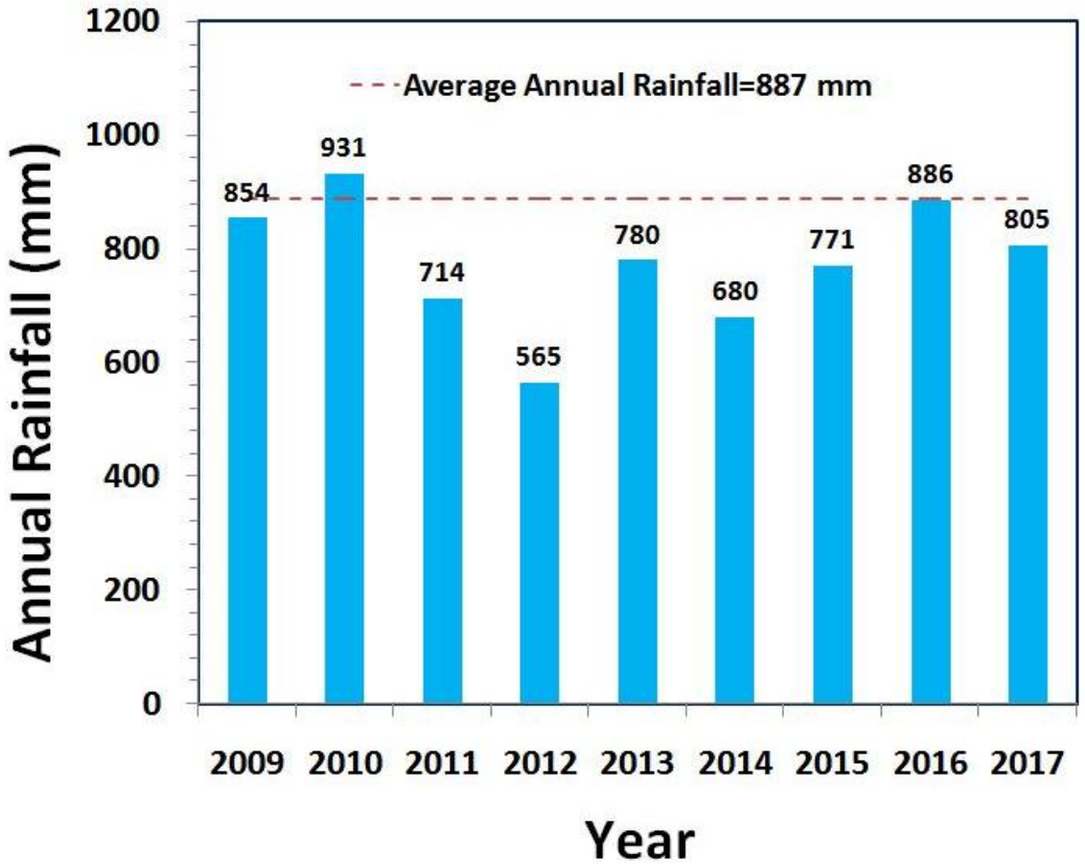






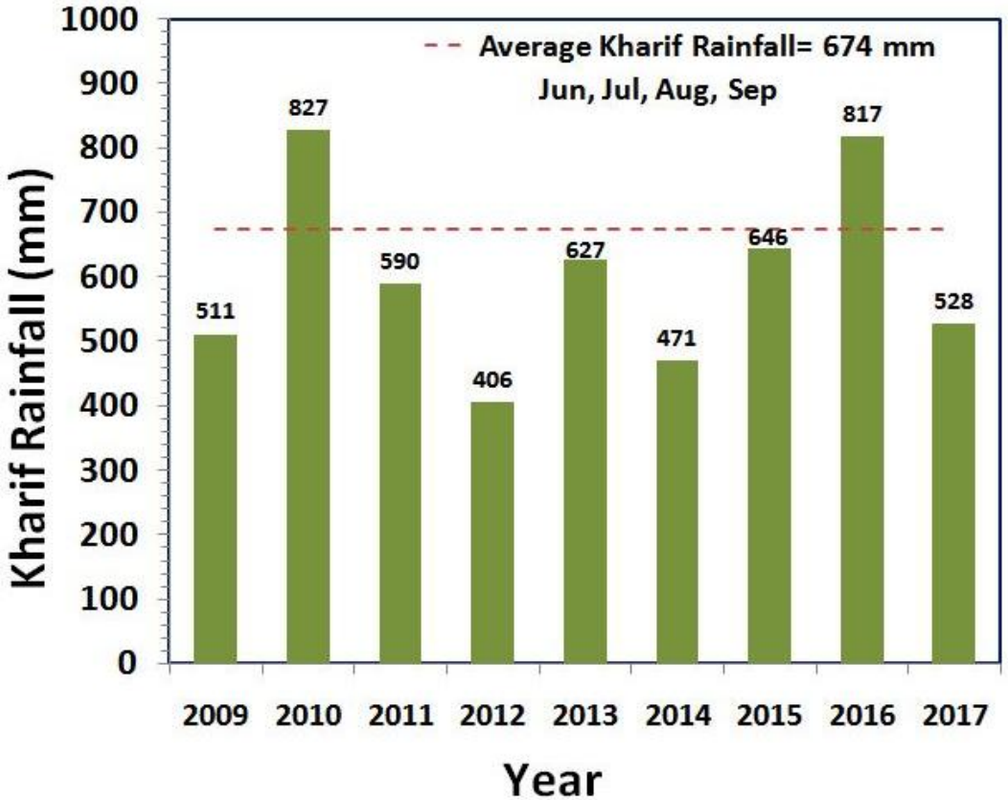
Soil & Water Conservation Structures in Bandehalli Sub-watershed, Yadgir taluk, Yadgir district

RAINFALL INDEX

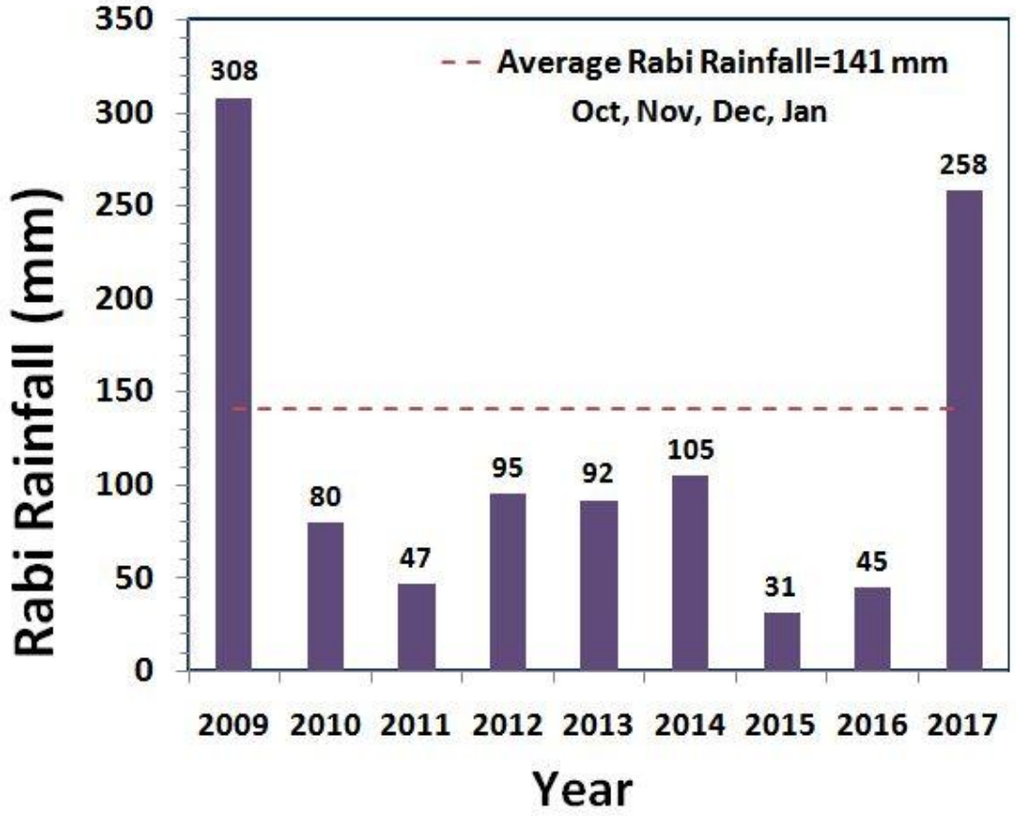


The average annual rainfall (1960-2014) recorded at the Yadgir station in Yadgir taluk of Yadgir district is 887 mm. The annual rainfall at Sydhapura station (Hobli H.Q.) is presented. During the years 2009, 2011, 2012, 2013, 2014, 2015 and 2017 the annual rainfall was deficient by 4%, 20%, 36%, 12%, 23%, 13% and 9% respectively.

The *kharif* rainfall (Jun–Sep) is an average about 77% of the annual rainfall and it typically follows the annual rainfall patterns. During the years 2009, 2011, 2012, 2013, 2014, 2015 and 2017 the *kharif* rainfall was deficient by 24%, 12%, 40%, 7%, 30%, 4% and 22% respectively.

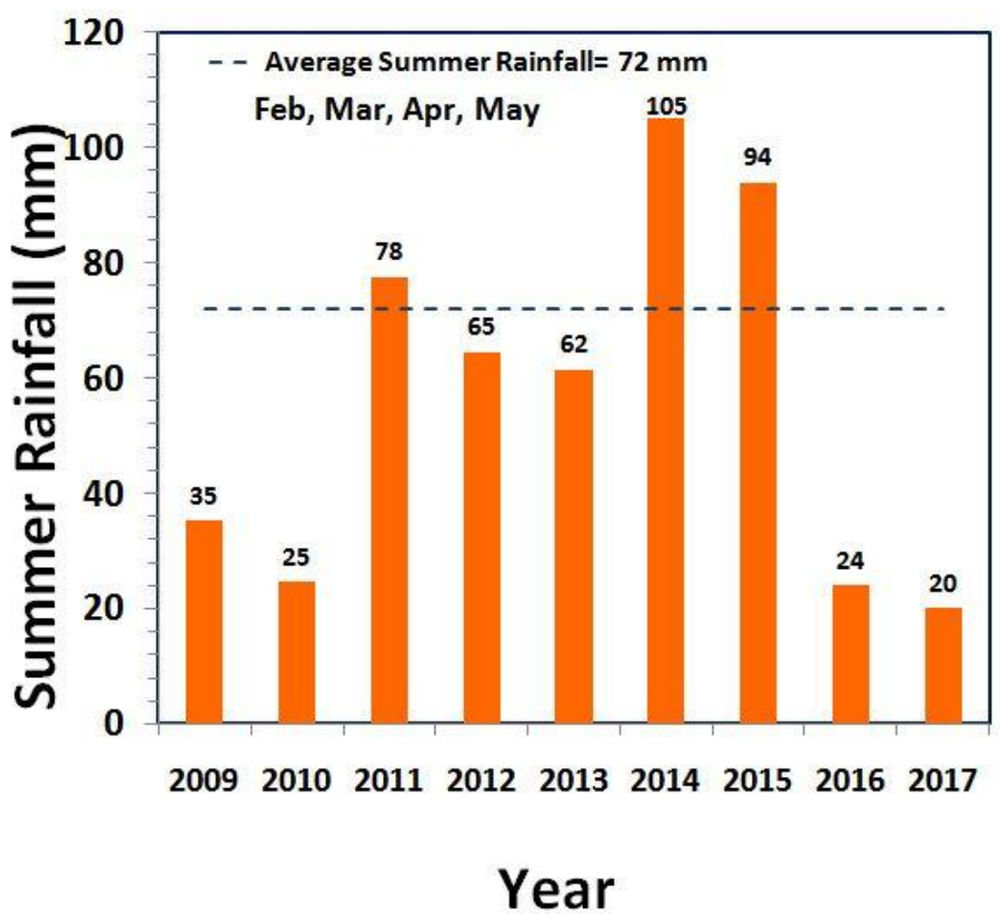


RAINFALL INDEX



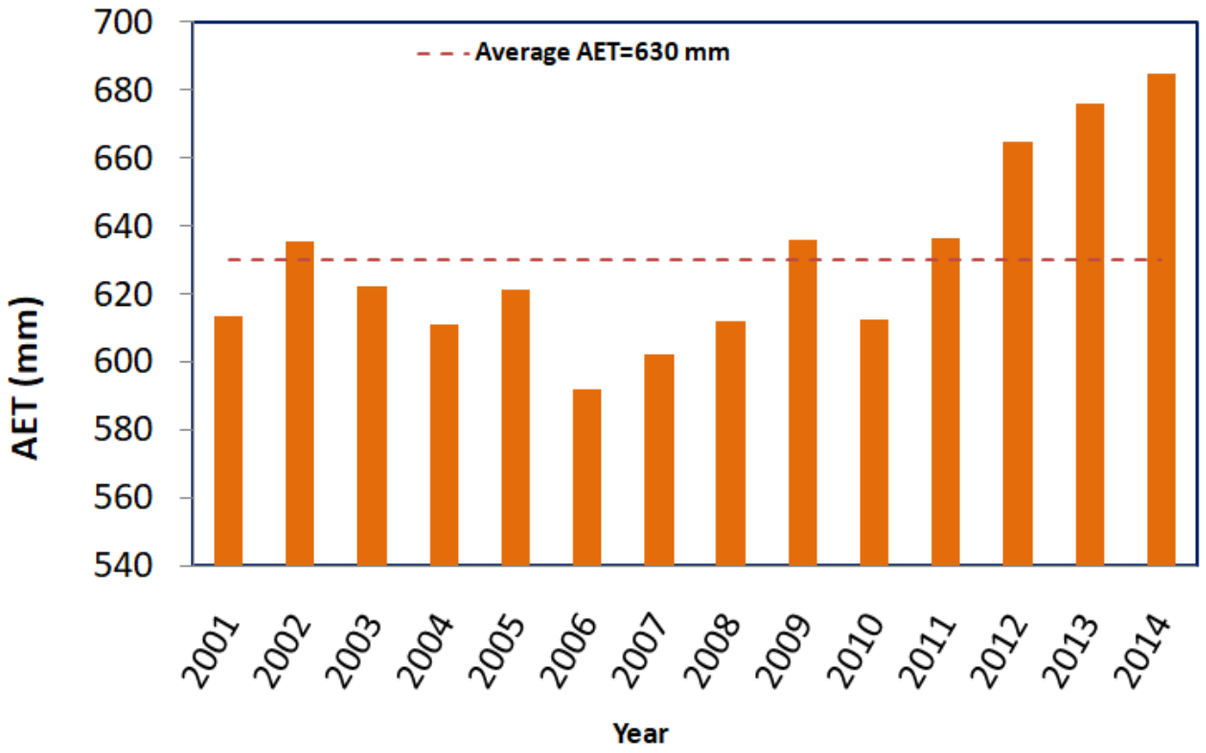
The average *rabi* rainfall (Oct-Jan) is about 15 % of the average annual rainfall. During the years 2009 and 2017 high *rabi* rainfall was received, where as other years showed deficient rainfall.

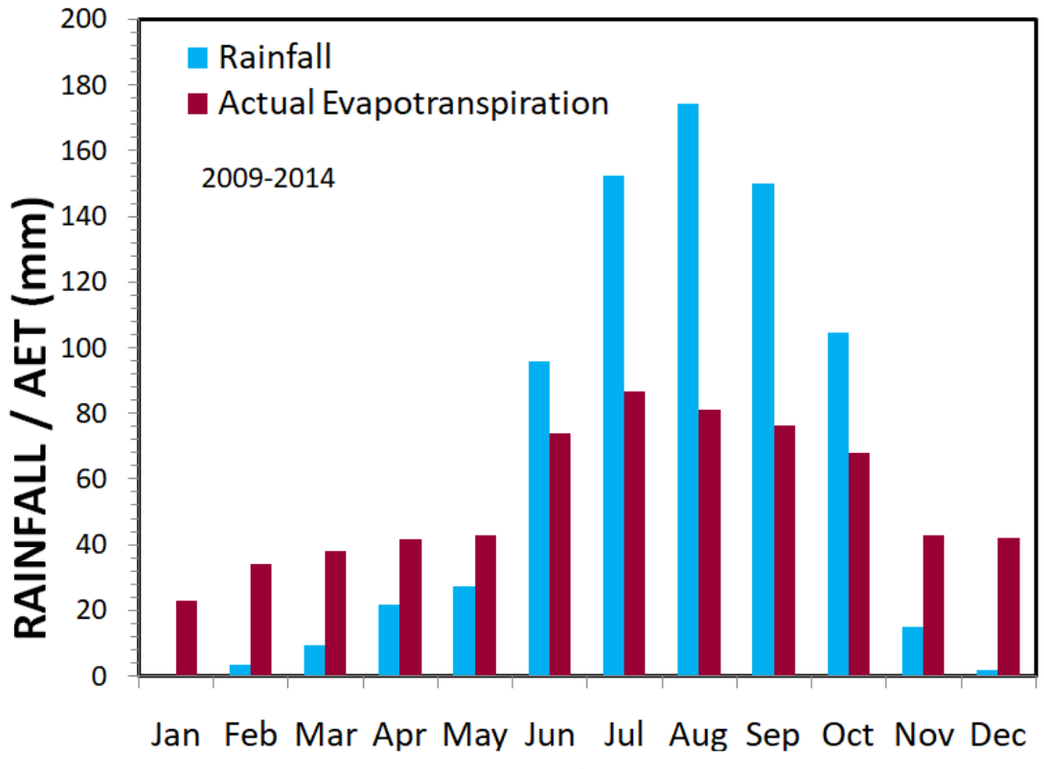
The average summer rainfall (Feb-May) is about 8% of the average annua rainfall.

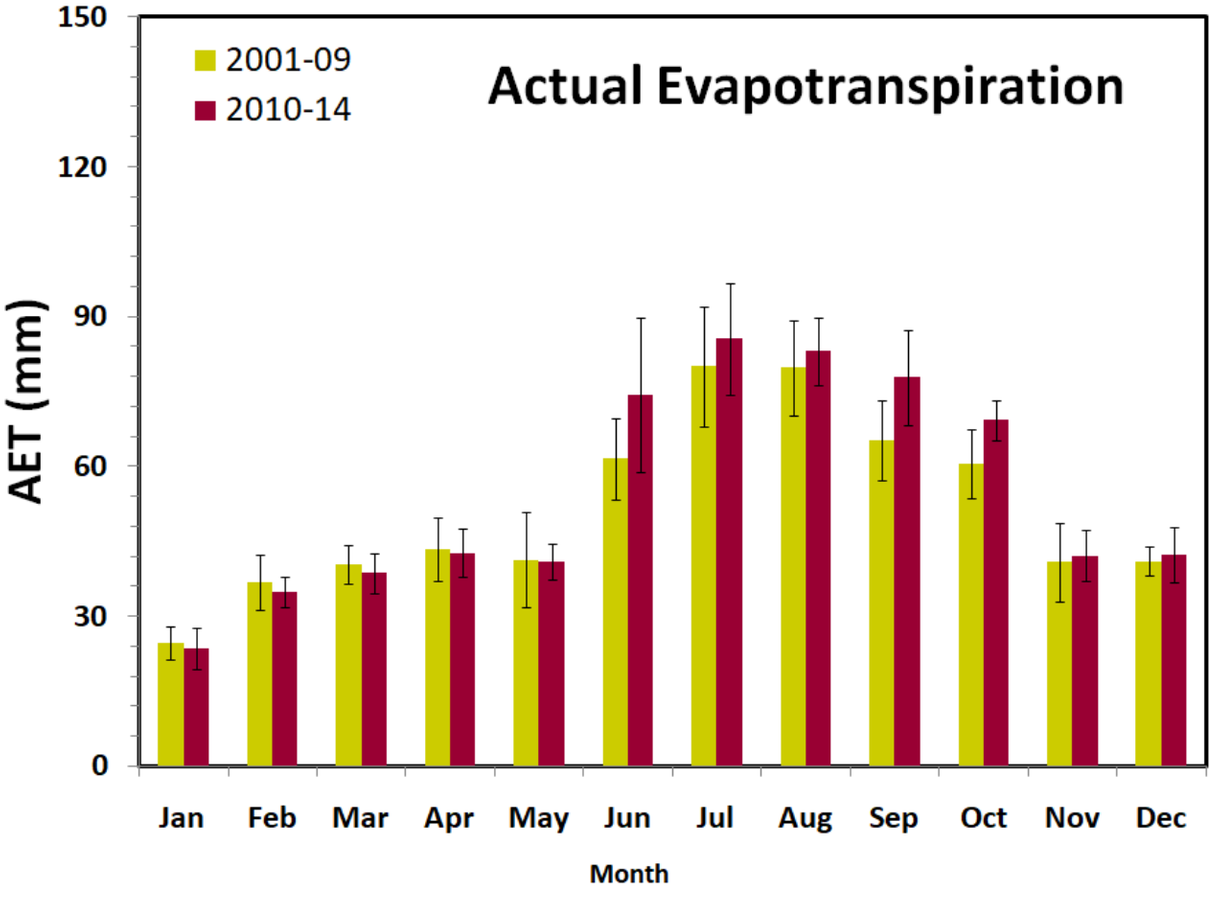


V

EVAPOTRANSPIRATION

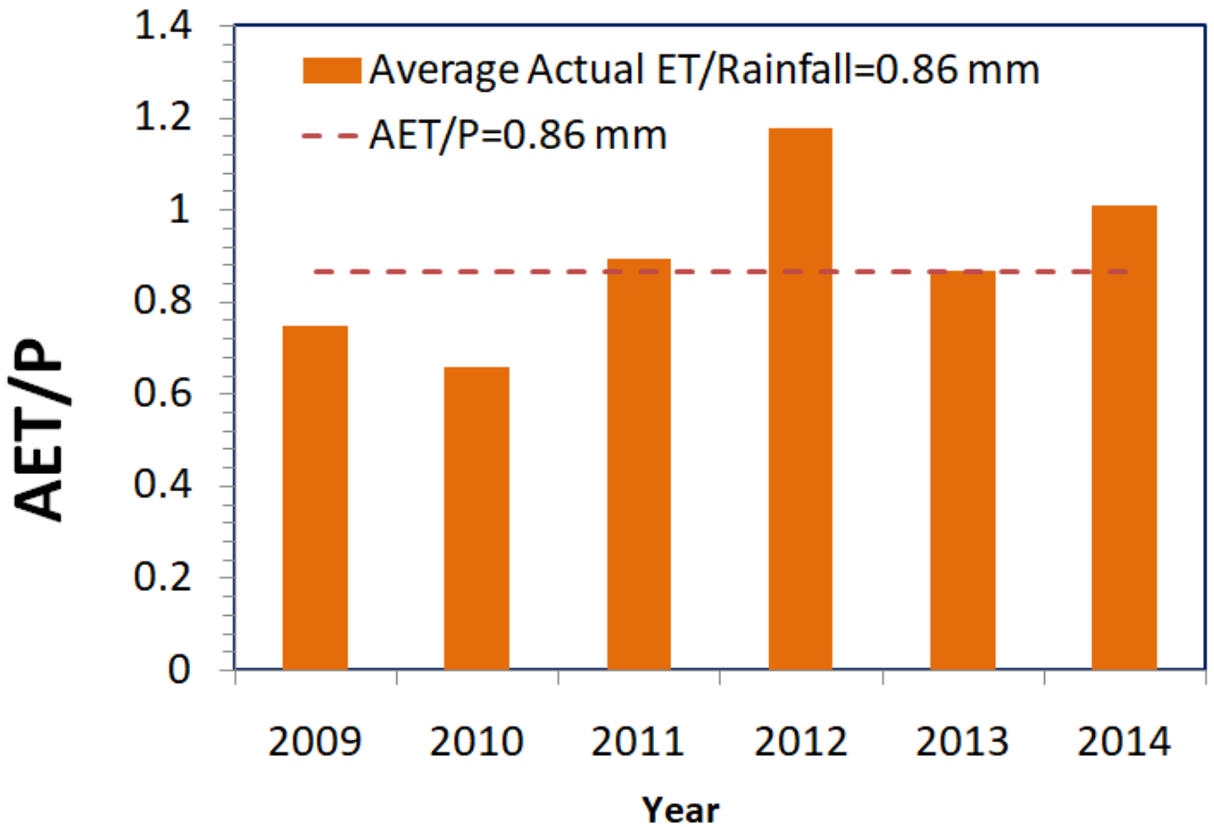




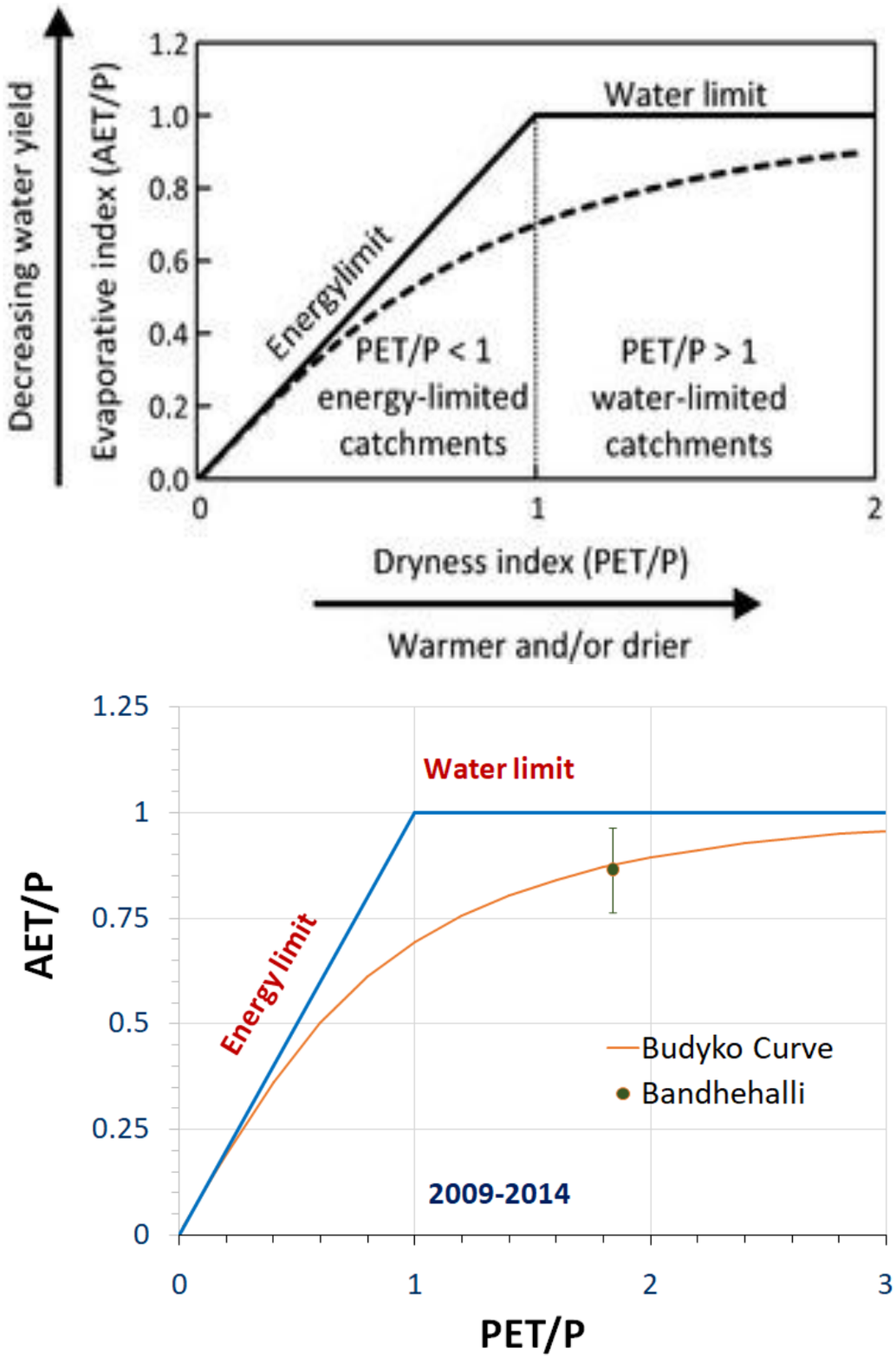


The average annual actual ET is lower than the average rainfall. During *kharif*, average rainfall and ET was found to be 674 mm and 318 mm respectively, whereas in *rabi* it was about 141 mm and 176 mm. In comparison to the 2001-2009, the annual ET increased by 6% during 2010-2014.

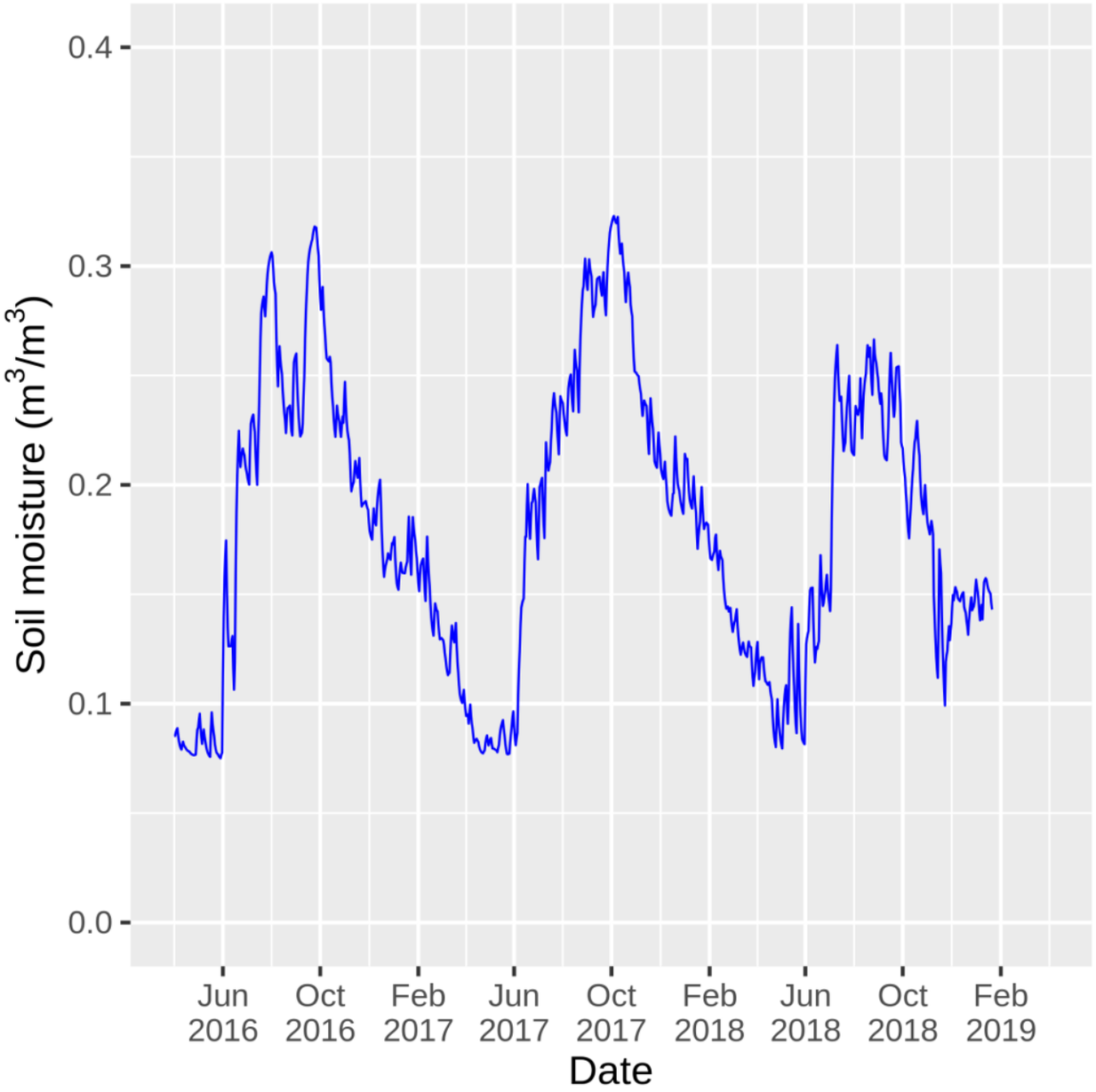
EVAPOTRANSPIRATION INDEX

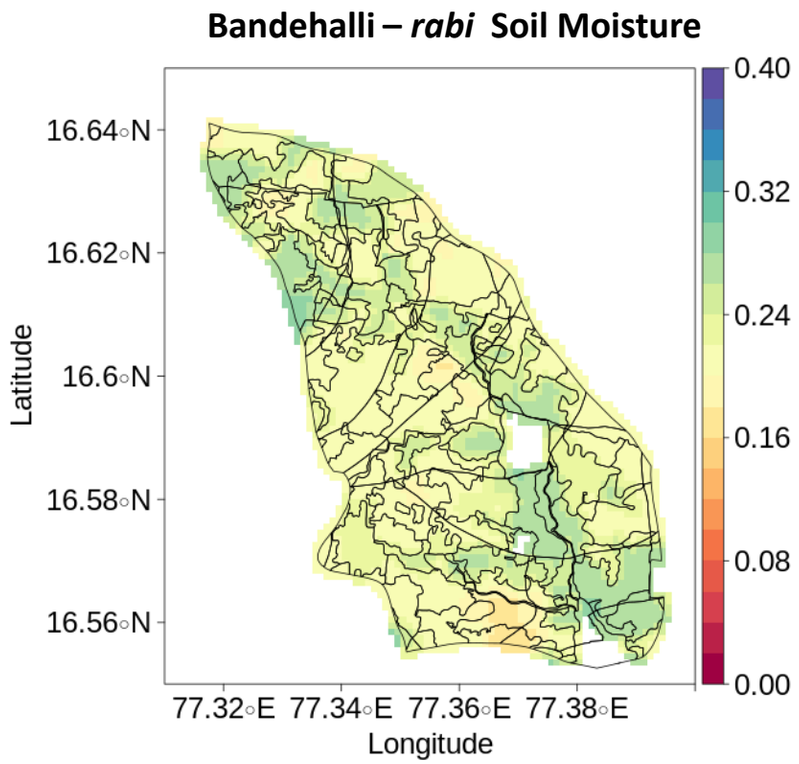


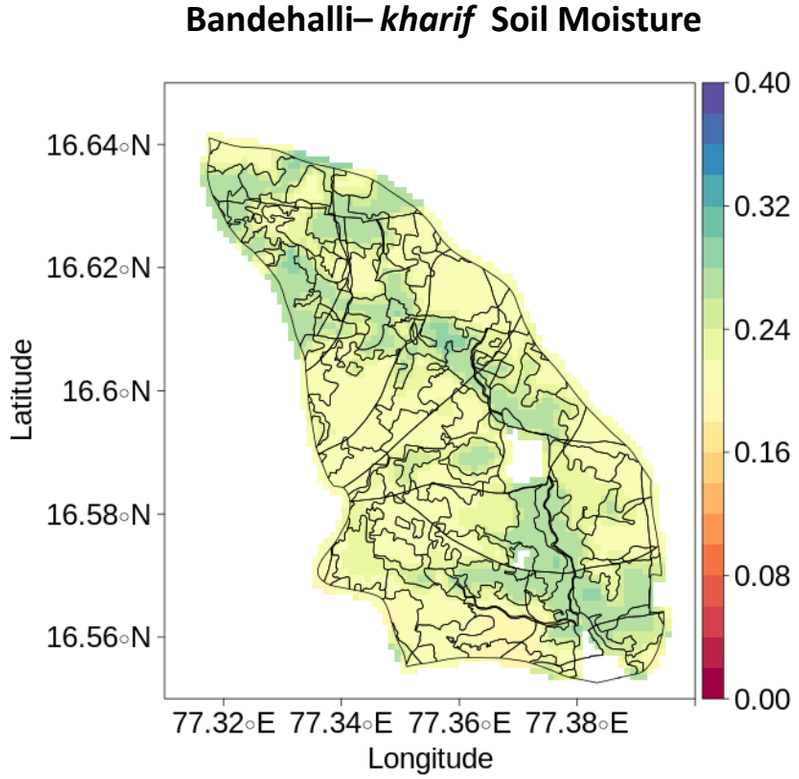
The watershed water balance is in deficit with the conjugative years (2011-2014), suggesting that worsening conditions. The location value on budyko curve suggests that watershed water balance is about to cross sustainable limit. So the cropping choices and irrigation choices have to be altered to reduce the total ET.



SATELLITE RETRIEVED SOIL MOISTURE





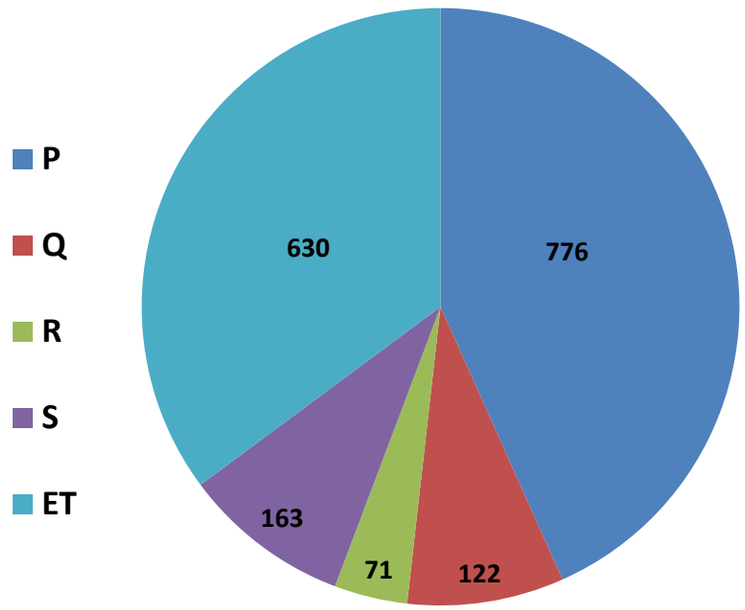


The method developed for retrieving soil moisture from multi-satellite observations allowed to map surface soil moisture behavior in the micro-watershed. The available surface moisture was varied in the range of 7-23% in *kharif* and 15-32% in *rabi* seasons of 2016, 8-30% in *kharif* and 15-34% in *rabi* seasons of 2017 and 7-27 % in *kharif* and 16-21% in *rabi* seasons of 2018.

WATER BALANCE

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

- Q = Runoff
- P = Precipitation
- E = Evapotranspiration
- R = Groundwater recharge
- S = Storage change in the watershed

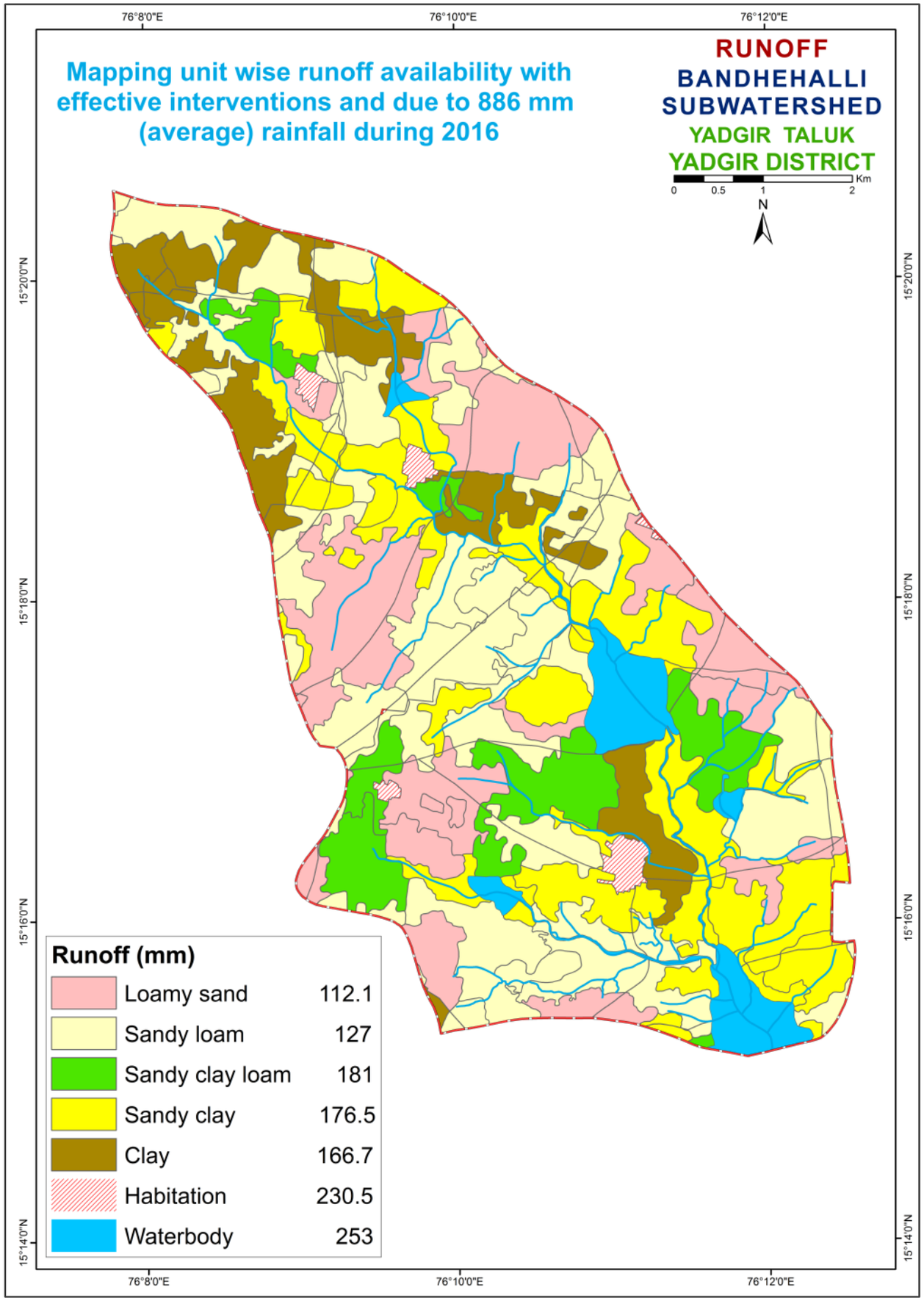


During June-October months, Precipitation is higher than Evapotranspiration, hence Runoff can occur in the watershed.

P = 776 mm (average of 2009-2017) ET = 630 mm R = 71 mm S = 163 mm Q = 122 mm

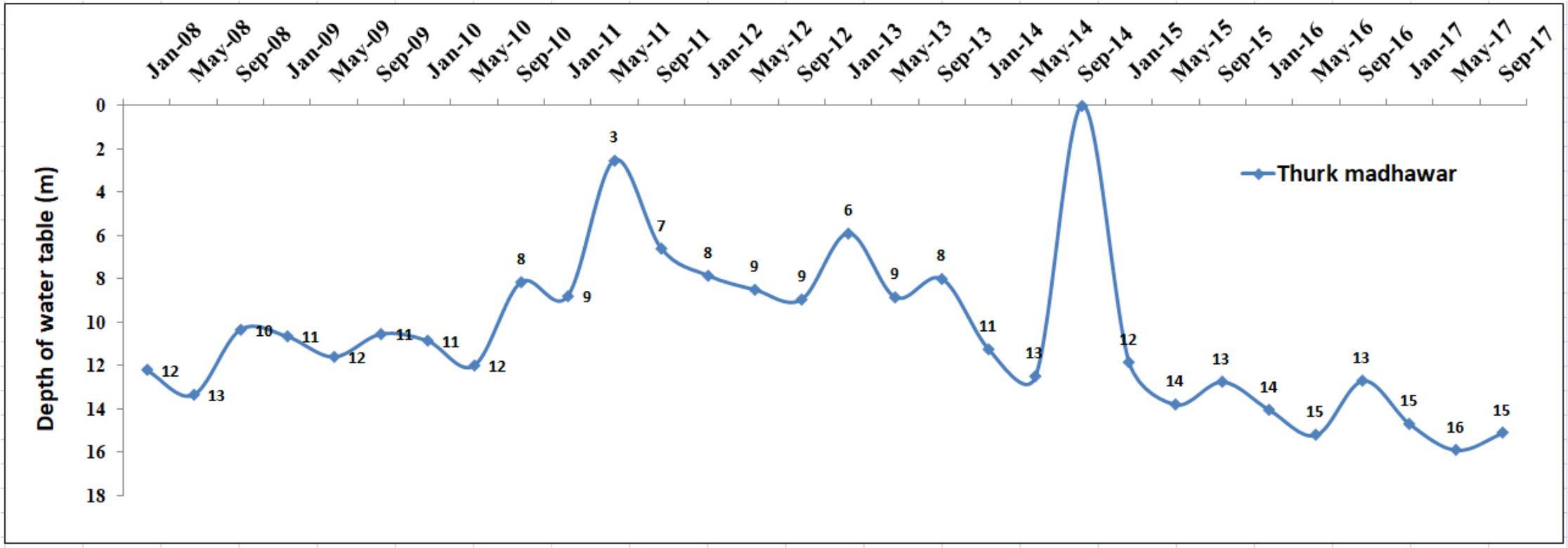
Sl. No.	Parameters	Average_ 2016 (mm)
1.	Rainfall	886
2.	Runoff availability with existing conditions	172
3.	Runoff availability with effective interventions	152
4.	Runoff allowed as environmental flow at the outlet	30.44
5.	Runoff excess for harvesting by construction of structures	121.76

RUNOFF


Mapping unit wise runoff availability with effective interventions and due to 886 mm (average) rainfall during 2016
RUNOFF
BANDHEHALLI
SUBWATERSHED
YADGIR TALUK
YADGIR DISTRICT
0 0.5 1 2 Km
N
76°8'0"E
76°10'0"E
76°12'0"E
15°20'0"N
15°18'0"N
15°16'0"N
15°14'0"N
Runoff (mm)
Loamy sand 112.1
Sandy loam 127
Sandy clay loam 181
Sandy clay 176.5
Clay 166.7
Habitation 230.5
Waterbody 253

GROUND WATER STATUS

THURK MADHWAR STATION



The total number of wells present in Bandehalli Sub-watershed as per LRI data is 63 (61-Borewells & 2-Openwells). The groundwater level was found from the data obtained from KSNDMC for the nearest station Thurk madhwar. The above graph depicts the groundwater levels during the years 2010-2011 & 2014 was inclined whereas groundwater levels from 2008-2010, 2015-2017 was almost constant and groundwater levels during 2011-2014 are slightly varying. Deepest levels were found in 2017.

x

SUMMARY

- The average annual rainfall of 887 mm in the Bandehalli sub-watershed as recorded from the Sydhapura station data by KSNDMC.

- 77 percent, 15 percent and 8 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 122 mm for an annual rainfall of 776 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 (163 mm) and utilizable runoff plus recharge is 334.7 (=122+163+49.7) i.e. approximately 335 mm.

- The average actual evapotranspiration estimated in the watershed based on the current land use and irrigation practices for the Kharif and Rabi seasons is 494 mm. Hence the amount of water use for Kharif and Rabi seasons may be estimated as 617 mm (i.e 125% of AET). This demand for the two seasons is marginally higher by 282 mm, i.e. (617-335).

- The total number of wells present in Bandehalli Sub-watershed as per LRI data is 63 (61-Borewells & 2-Openwells). The groundwater level was found from the data obtained from KSNDMC for the nearest station Thurk madhwar .