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Research Article

"Geospatial Evaluation of Soil Properties through GIS in Devanahalli Taluk, Karnataka"

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ABSTRACT

The soil can be defined as the delicate thin layer of material that covers the land and is generally regarded as a natural resource. The term soil as we must understand is able to perform a number of functions and these include being able to ensconce different physical and chemical activities along with a vast assortment of microorganisms. The project's goal, thus, is to evaluate certain types of factors by measuring the soil properties and the amount of spatial variation in its properties. The objectives of the mapping project, which is a pilot in nature, are to collect, summarize and analyze specific measurements aimed at understanding the spatial characteristics of soil properties in the area located within the Devanahalli taluk. Hence, a temperature of the areas under investigation, along with soil moisture, soil properties of pH, potassium (K), phosphorus (P), and organic carbon (OC) of the soil, were synthesized within the analytical models in response to the target area.

Keywords: soil properties, satellite data, soil maps, spatial analyses, soil quality, soil nutritents, agricultural use, construction use, GIS,

INTRODUCTION

As defined, soil is a thin layer of earth's crust which helps for the plants' growth in the natural medium. From the parent material of rocks, minerals, organisms, climate and topography, soil is existed and created by a period of time in the nature. Soil differs from the morphological, physical, chemical and biological properties. In accordance with the genetic and environmental factors soil can be differ in their properties. That is the reason why some soils are certain soils are dense so some are red some are black cotton and some are shallow some are loose soils and some are loams. These different types of soil serve differently in soil nutritionally's for the growth of plant[6]. The components of soils are water, air, mineral material organic matter explanation and all these components are the proportions of which vary and which together form a system for plant growth therefore the need to study the soils in perspective[7]. Adequate knowledge regarding the physical and chemical as well as biological properties of the soil will provide greater insight into the dynamics of these soils.

- Physical Properties
- Chemical Properties
- Soils can be differentiated on the basis of their physical parameters such as tissue constitution, grouping, and the total soil volume being wheat.

Chemical parameters of soil include: Ph, organic matter, total nitrogen, calcium, magnesium (Mg), potassium (K), phosphorous, iron (Fe), and EC level among others. Such are the chemical parameters of soil. The picture identified tells that the micro nutritients are essential in sustaining the efficiency of crops. Stability and sustainability of the soil solely relies on its micro nutritiernts. The relationships between the nutrition health and the soil health is the factor to determine the efficiency of crops. The levels of crops susceptivity rely on the micro nutriens levels of the soil. These are needed in very small amounts. The soil must supply micronutrients for desired growth of plants and to synthesize human food. In the month of March, samples were collected from 30 villages of Devanahalli taluk and tested.

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Devanahalli taluk is characterized by clayey mixed, clayey, loamy soil and rocks found in the land[8]. The soil formed on the surface has a coarse texture and the overall profile is deep and rough textured. This information is obtained in the paper (S. Srinivasa Vittala et al. (2008)) Therefore, the data was presented using Geographic Information System (GIS) that is also a computer based information system used for capturing, storing, manipulating, analyzing, managing, and presenting spatial or geographic data[9].

GPS, otherwise referred to as Global Positioning System, is a global satellite radio navigation and surveying system with area or site specific localization applications that are responsive in nature. The study includes the mapping of the regional areas of spatial distribution[10]. Nowadays, as more and more information and material are digitized, it becomes feasible to create programs that would aid in the identification of soil properties as well as the creation of soil properties and nutrient content maps combined with a GIS.

Evaluation of Moisture Content, Soil Erodibility and Soil Texture in Paderu Mandal, Visakhapatnam District, Andhra Pradesh Based on Geospatial Technology Ramprasad Naik Desavathu et.al (2016) in this paper has a goal to see the soil pH values ranged from 4.8 to 7.5, nearly 83% of the total area under study has acidic characteristics[12]. The value of electrical conductivity has ranges from 0.04- 0.87 ds/m which indicates that soils are saline in nature The area of study 435km2 of total study area 99% of area is low in nitrogen followed by potassium and phosphorus in the respective proportions of 70% and 42%. Soil fertility is one of the important constraints to agricultural production in the developing countries[13].

Assessment of spatial variability in the methods for predicting nutrient status in soils and recommendation regarding nutrient application in Alanantha cluster villages, Ramanagara District, Karnataka utilizing GIS[14].

Sathish and colleagues (2016) aimed to quantify how soil fertility properties vary across space. They looked at soil organic carbon (OC) available nitrogen (N) available phosphorus (P) available potassium (K), and other nutrients in the top layer of soil (0-30 cm deep) from 67 farms in Alanatha Cluster Villages, Kanakapura Taluk, Ramanagara District Karnataka[15]. They made thematic maps based on nutrient ratings. To show soil fertility changes in the chosen project area, they used Arc GIS software. S.K.Reza and others (2017) set out to measure soil pH and OC, AN, AP, and AK values. These ranged from 3.4 to 8.2, and 0.2–43.4 1.1–37.3. Among soil properties, phosphorous showed more variation than pH. The exponential model fit best for the other component, while all property ranges stayed within limits[16].

In this paper Gouri Sankar Bhunia et.al (2015) The study aims to grasp how soil properties vary across space using a geo statistical model. Researchers measured soil pH electrical conductivity, Nitrogen Potassium and organic carbon Phosphorus[17]. They used Semi variogram model and kriging techniques to create surface maps of soil properties. The study found a link between organic carbon and nitrogen in the soil. Quantile-quantile plots revealed that all soil properties followed a normal distribution. K N, and EC had nugget values of 0.25–0.75 pointing to moderate spatial auto correlation among these variables[18].

OBJECTIVES

- **Map the soil properties** such as texture, pH, organic carbon content, nutrient levels, and soil moisture across various regions of Devanahalli Taluk.
- **Evaluate the spatial variation** of soil properties to understand regional differences, land-use patterns, and agricultural suitability.
- **Identify soil degradation** areas, if any, and provide recommendations for sustainable land management and agricultural practices.
- **Develop a soil property database** that can assist in decision-making processes related to agriculture, land use planning, and environmental management.
- **Integrate remote sensing data** with GIS to enhance the accuracy and coverage of soil property mapping in the study area

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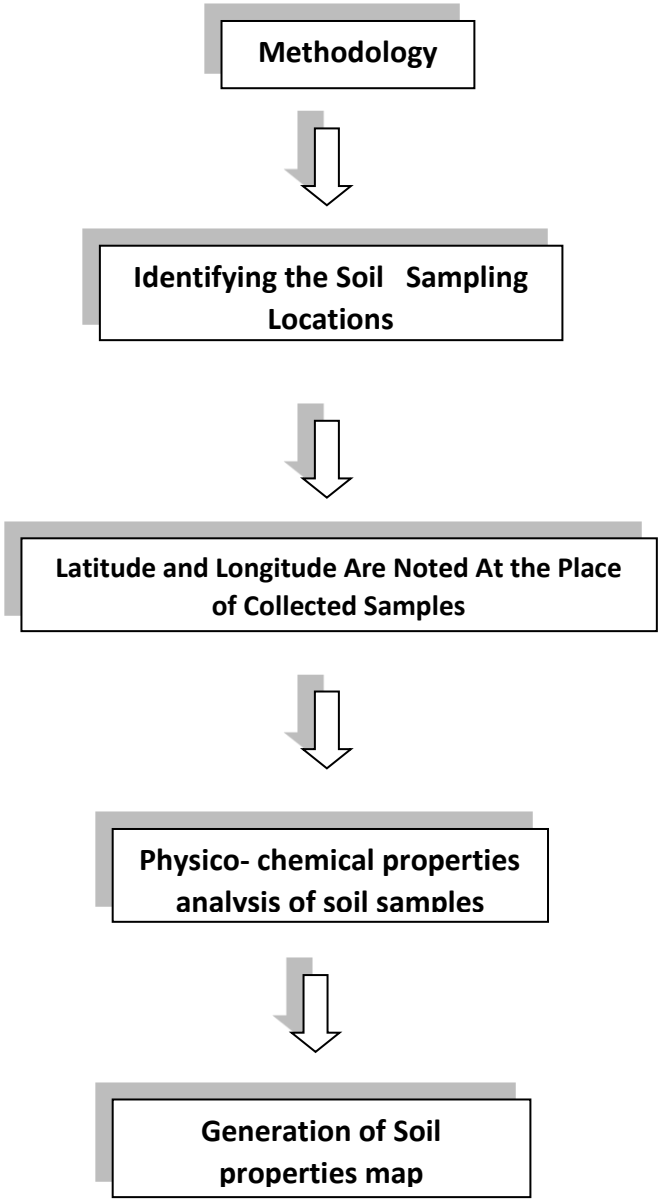
METHODS



We started by reviewing existing literature on the topic. Next, we got a topographical map from Google Earth Pro. We then picked villages for soil sample collection. In March, we gathered the needed amount of samples from each spot in sampling bottles labeled them, and sent them to a lab for more tests on physic chemical factors. After that, we made soil properties maps of all samples [5]. To finish, we used ARC-GIS software to create a visual representation of soil properties on a map.

Identifying the Soil Sampling Locations

We chose the area to analyze the soil's physical and chemical properties. Our focus was on Devanahalli taluk in Bengaluru Rural district. The rapid growth of Bengaluru urban city and the presence of KIA (Kempegowda International Airport) make it crucial to study this area to ensure Bengaluru city's future sustainability. Next, we picked eleven locations in the study area: Bychapura, Chikkasanne, Kommasandra, Dharmapura, Devanahalli town,

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Bettakote, Byrapura, Kasaba, Venkatapura, Varadhenahalli, and Bedrahalli. Etc. which is mentioned in Table-1. We recorded the latitude and longitude at each sample collection site[3]. These coordinates show the exact positions where we gathered the soil samples [4].

TABLE- 1 Latitude and longitude details

SL NO	LOCATION	LATIUDE NORTH	LONGITUDE EAST
1	Bychapura	**13 13'28 "**	**77 42' 43"**
2	Chikkasanne	**13 13' 49"**	**77 41' 19"**
3	Kommasandra	**13 19' 56"**	**77 47' 17"**
4	Dharamapura	**13 14' 47"**	**77 47' 38"**
5	Devanahalli	**13 14' 57"**	**77 42' 30"**
6	Bettakote	**13 11' 57"**	**77 44' 20"**
7	Byrapura	**13 21' 43"**	**77 26' 15"**
8	Kasaba	**13 16' 57"**	**77 32' 51"**
9	Venkatapura	**13 15' 29"**	**77 35' 48"**
10	Varadhenahalli	**13 08' 42"**	**77 19' 55"**
11	Bedarahalli	**13 16' 13"**	**7739' 26"**
12	Kondenahalli	**12 58' 8.39"**	**77 43' 19"**
13	Abachikkanahalli	**13 27' 88"**	**77 72' 26"**
14	Agalakote	**13 21' 54"**	**77 72' 66"**
15	Akkupet	**12 52' 10.2"**	**77 33' 01"**
16	Anighatta	**13 27' 82"**	**77 69' 00"**
17	Binnamangala	**13 46' 66"**	**77 87' 91"**
18	Boovanahalli	**12 77' 29"**	**76 43' 09"**
19	Budigere	**13 04' 28"**	**77 46' 6"**
20	BudigereAmanikee	**13 13' 51"**	**77 74' 97"**
21	Kottigethimmanahalli	**13 93' 20"**	**76 60' 29"**
22	Chikkannanahosahali	**13 21' 06"**	**77 56' 91"**
23	Chikkasanne	**13 23' 05"**	**77 70' 20"**
24	Gobbarakunte	**12 58' 18"**	**77 35' 37"**
25	Handrahalli	**13 12' 11"**	**77 75' 16"**
26	Hegganahalli	**13 00' 64"**	**77 51' 71"**
27	Holerahalli	**13 33' 41"**	**77 74' 81"**
28	Irigenahalli	**13 33' 24"**	**77 73' 27"**
29	Jonnahalli	**13 18' 00"**	**77 75' 52"**
30	Karahalli	**13 32' 77"**	**77 69' 01"**

Table-1 shows the latitude and longitude of the details which were recorded in the study area.

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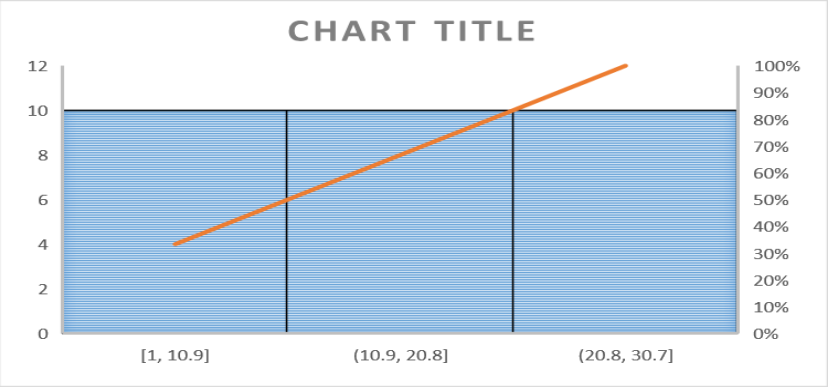

Fig: 1 shows the latitude longitude chat

Physico-chemical analysis of soil samples

During this phase, data on various physicochemical parameters were analyzed in the environmental laboratory [1]. In simpler terms, the procedures were experimental with respect to collecting soil samples in order to obtain the content of the respective physicochemical parameters [2].

The tested Physical and chemical Parameters are listed below

- Soil reaction (Ph)
- Phosphorus(P_2O_5)
- Electrical conductivity (EC)
- Salinity
- Organic carbon %
- Soil textures
- Moisture %
- Potassium(K_2O)
- Boron
- Calcium
- Sulphur(S)
- Magnesium (Mg)
- Copper (Cu)
- Fe

These are the physio-chemical parameters which were tested in lab [11].

RESULTS

The result of also the physic- chemical parameters is obtained by various tests

Various test details and method for different parameters are shown in table.2 and in table.3

TABLE-2 TEST DETAIL

SL NO	PARAMETERS	TEST ADOPTED
1	Ph	Electrometer (PH meter)
2	Phoshorous	Olsens method
3	Electrical conductivity	EC meter
4	Salinity	Soil to water method

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5	Organic carbon %	UV spectrophoto meter
6	Silt & clay %	Bouyoucosl method
7	Moisture %	Gravimetric Method
8	Potassium	Direct method
9	Sulphur	Gravimetric method
10	Boron	Hot water extrcation method

Result of physical and chemical parameters

TABLE-3 Test result of Soil reaction (pH)

SL NO	LOCATION	pH	Normal / Sufficient Range
1	Bychapura	7.16	6.3-8.3
2	Chikkasanne	7.92	6.3-8.3
3	Kommasandra	7.95	6.3-8.3
4	Dharamapura	7.24	6.3-8.3
5	Devanahalli	7.27	6.3-8.3
6	Bettakote	7.32	6.3-8.3
7	Byrapura	7.28	6.3-8.3
8	Kasaba	7.29	6.3-8.3
9	Venkatapura	7.37	6.3-8.3
10	Varadhenahalli	7.38	6.3-8.3
11	Bedarahalli	7.98	6.3-8.3
12	Kondenahalli	7.32	6.3-8.3
13	Abachikkanahalli	7.56	6.3-8.3
14	Agalakote	7.15	6.3-8.3
15	Akkupet	7.64	6.3-8.3
16	Anighatta	7.26	6.3-8.3
17	Binnamangala	7.85	6.3-8.3
18	Boovanahalli	7.93	6.3-8.3
19	Budigere	7.59	6.3-8.3
20	BudigereAmanikee	7.84	6.3-8.3
21	Kottigethimmanahalli	7.47	6.3-8.3
22	Chikkannanahosahalli	7.34	6.3-8.3
23	Chikkasanne	7.88	6.3-8.3
24	Gobbarakunte	7.97	6.3-8.3
25	Handrahalli	7.22	6.3-8.3
26	Hegganahalli	7.16	6.3-8.3
27	Holerahalli	7.45	6.3-8.3
28	Irigenahalli	7.58	6.3-8.3
29	Jonnahalli	7.49	6.3-8.3
30	Karahalli	7.89	6.3-8.3

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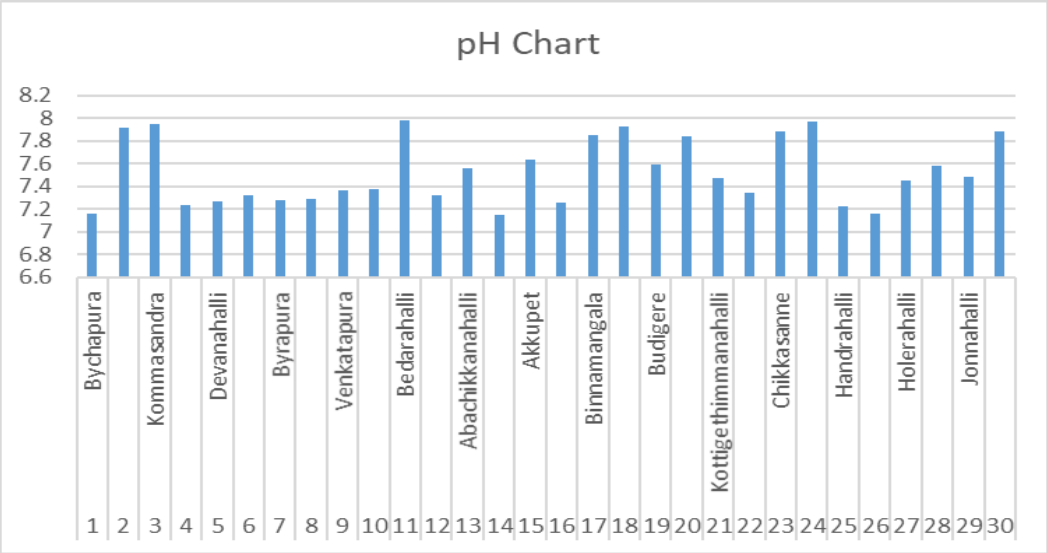

Fig.1 Test result of Soil reaction (p^H)

TABLE-4 Test result of Phosphorous

SL. NO	LOCATION	Phosphorous(P2O5) kg/acre	Normal/ sufficient Range
1	Bychapura	28.0	10.0-25.0
2	Chikkasanne	28.0	10.0-25.0
3	Komasandra	27.9	10.0-25.0
4	Dharamapura	27.4	10.0-25.0
5	Devanahalli	27.2	10.0-25.0
6	Bettakote	29	10.0-25.0
7	Byrapura	28.1	10.0-25.0
8	Kasaba	28.6	10.0-25.0
9	Venkatapura	26.1	10.0-25.0
10	Varadhenahalli	28.4	10.0-25.0
11	Bedarahalli	28.6	10.0-25.0
12	Kondenahalli	27.3	10.0-25.0
13	Abachikkanahalli	29.5	10.0-25.0
14	Agalakote	28.1	10.0-25.0
15	Akkupet	27.9	10.0-25.0
16	Anighatta	26.2	10.0-25.0
17	Binnamangala	27.3	10.0-25.0
18	Boovanahalli	28.4	10.0-25.0
19	Budigere	29.2	10.0-25.0
20	BudigereAmanikee	26.5	10.0-25.0
21	Kottigethimmanahalli	27.9	10.0-25.0
22	Chikkannanahosahalli	28.5	10.0-25.0
23	Chikkasanne	27.3	10.0-25.0
24	Gobbarakunte	29.4	10.0-25.0

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25	Handrahalli	29.1	10.0-25.0
26	Hegganahalli	28.6	10.0-25.0
27	Holerahalli	26.9	10.0-25.0
28	Irigenahalli	27.4	10.0-25.0
29	Jonnahalli	28.9	10.0-25.0
30	Karahalli	26.7	10.0-25.0

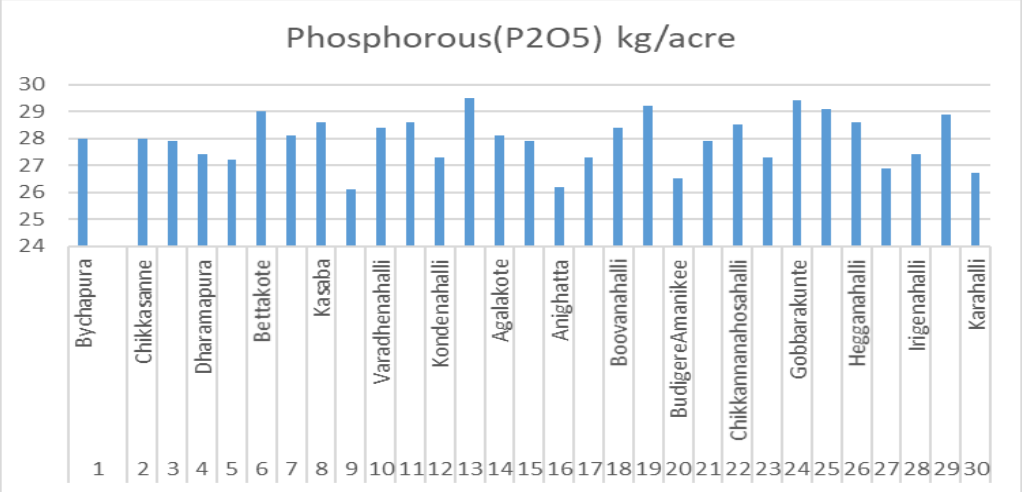

Fig.2 Test result of Phosphorous**(P2O5)**

TABLE-5 Test result of Electrical conductivity micro Siemens

SL NO	**LOCATION**	**EC (micro 282iemens)**	**Normal/ sufficient Range**
1	Bychapura	0.13	0.01-1.0
2	Chikkasanne	0.12	0.01-1.0
3	Kommdra	0.14	0.01-1.0
4	Dharamapura	0.15	0.01-1.0
5	Devanahalli	0.12	0.01-1.0
6	Bettakote	0.15	0.01-1.0
7	Byrapura	0.14	0.01-1.0
8	Kasaba	0.20	0.01-1.0
9	Venkatapura	0.12	0.01-1.0
10	Varadhenahalli	0.23	0.01-1.0
11	Bedarahalli	0.20	0.01-1.0
12	Kondenahalli	0.16	0.01-1.0
13	Abachikkanahal li	0.18	0.01-1.0
14	Agalakote	0.14	0.01-1.0
15	Akkupet	0.15	0.01-1.0
16	Anighatta	0.19	0.01-1.0
17	Binnamangala	0.22	0.01-1.0
18	Boovanahalli	0.20	0.01-1.0
19	Budigere	0.23	0.01-1.0
20	BudigereAmanikee	0.12	0.01-1.0

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21	Kottigethimmanahalli	0.21	0.01-1.0
22	Chikkannanahosahalli	0.24	0.01-1.0
23	Chikkasanne	0.22	0.01-1.0
24	Gobbarakunte	0.19	0.01-1.0
25	Handrahalli	0.15	0.01-1.0
26	Hegganahalli	0.21	0.01-1.0
27	Holerahalli	0.20	0.01-1.0
28	Irigenahalli	0.18	0.01-1.0
29	Jonnahalli	0.25	0.01-1.0
30	Karahalli	0.14	0.01-1.0

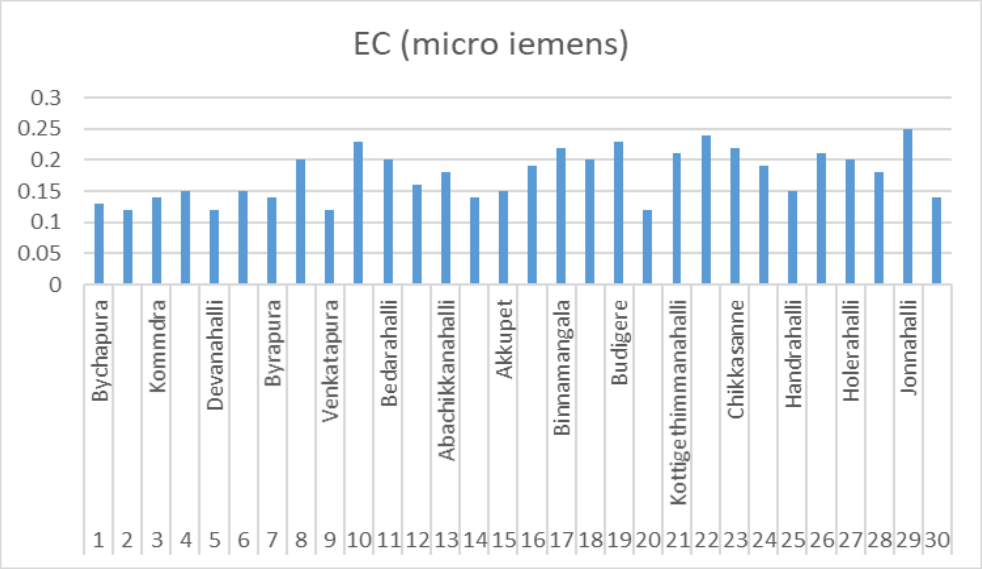

Fig.3 Test result of Electrical conductivity micro Siemens

TABLE-6 Test result of Salinity (mg/kg)

SL NO	LOCATION	Salinity(mg/kg)	Normal/ sufficient range
1	Bychapura	53.0	-----
2	Chikkasanne	49.0	-----
3	Kommasandra	48	-----
4	Dharamapura	47.0	-----
5	Devanahalli	53.9	-----
6	Bettakote	54.2	-----
7	Byrapura	52.9	-----
8	Kasaba	53.12	-----
9	Venkatapura	46.1	-----
10	Varadhenahalli	48.9	-----
11	Bedarahalli	51.9	-----
12	Kondenahalli	50.9	-----
13	Abachikkanahalli	41.3	-----

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14	Agalakote	46.2	-----
15	Akkupet	43.4	-----
16	Anighatta	45.5	-----
17	Binnamangala	27.1	-----
18	Boovanahalli	51.2	-----
19	Budigere	52.0	-----
20	BudigereAmanikee	49.2	-----
21	Kottigethimmanahalli	47.9	-----
22	Chikkannanahosahalli	50.3	-----
23	Chikkasanne	47.8	-----
24	Gobbarakunte	49.7	-----
25	Handrahalli	46.6	-----
26	Hegganahalli	42.3	-----
27	Holerahalli	45.9	-----
28	Irigenahalli	52.6	-----
29	Jonnahalli	55.5	-----
30	Karahalli	54.9	-----

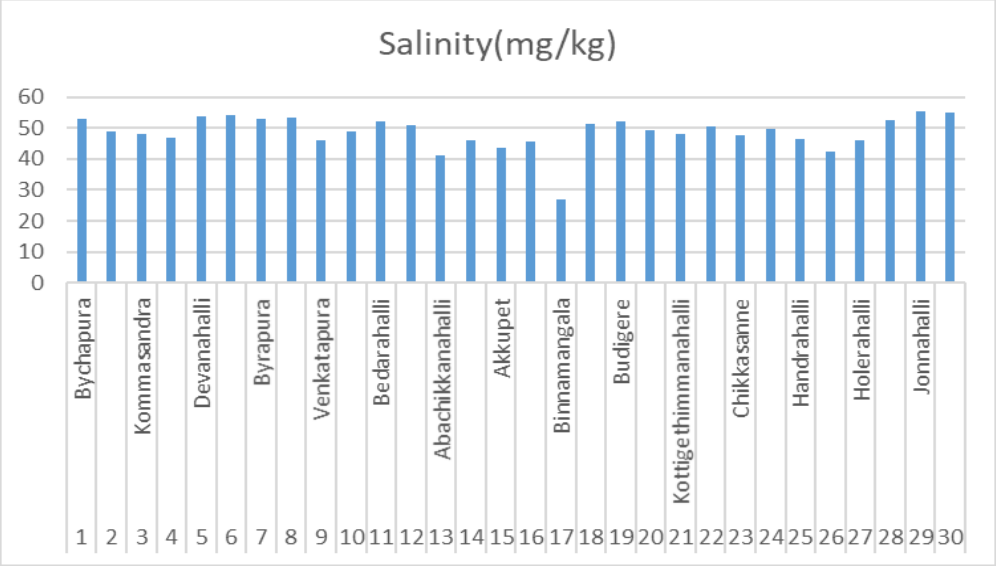

Fig.4 Test result of Salinity (mg/kg)

TABLE-7 Test result of Organic carbon %

SL NO	**LOCATION**	**Organic carbon %**	**Normal / sufficient Range**
1	Bychapura	0.48	0.51-0.75
2	Chikkasanne	0.24	0.51-0.75
3	Kommasandra	0.23	0.51-0.75
4	Dharamapura	0.27	0.51-0.75
5	Devanahalli	0.49	0.51-0.75
6	Bettakote	0.42	0.51-0.75

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7	Byrapura	0.45	0.51-0.75
8	Kasaba	0.52	0.51-0.75
9	Venkatapura	0.23	0.51-0.75
10	Varadhenahalli	0.33	0.51-0.75
11	Bedarahalli	0.28	0.51-0.75
12	Kondenahalli	0.37	0.51-0.75
13	Abachikkanahall i	0.29	0.51-0.75
14	Agalakote	0.49	0.51-0.75
15	Akkupet	0.29	0.51-0.75
16	Anighatta	0.36	0.51-0.75
17	Binnamangala	0.42	0.51-0.75
18	Boovanahalli	0.35	0.51-0.75
19	Budigere	0.28	0.51-0.75
20	BudigereAmanikee	0.37	0.51-0.75
21	Kottigethimmanahalli	0.44	0.51-0.75
22	Chikkannanahosahalli	0.32	0.51-0.75
23	Chikkasanne	0.29	0.51-0.75
24	Gobbarakunte	0.33	0.51-0.75
25	Handrahalli	0.40	0.51-0.75
26	Hegganahalli	0.31	0.51-0.75
27	Holerahalli	0.43	0.51-0.75
28	Irigenahalli	0.29	0.51-0.75
29	Jonnahalli	0.34	0.51-0.75
30	Karahalli	0.44	0.51-0.75

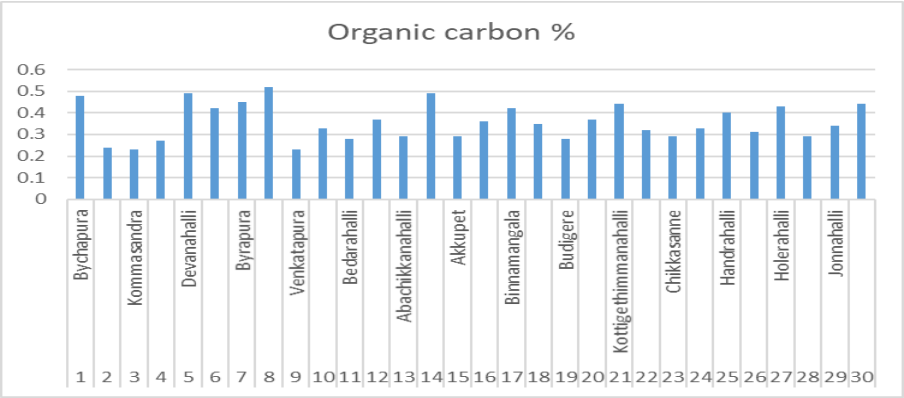

Fig.5 Test result of Organic carbon %

TABLE-8 Test result of Silt& clay %

SL NO	LOCATION	**Silt & clay conte nt %**	**Normal/ sufficient Range**
1	Bychapura	53.0	----
2	Chikkasanne	49.0	----
3	Kommasandra	48	----
4	Dharamapura	47.0	----

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5	Devanahalli	53.9	----
6	Bettakote	54.2	----
7	Byrapura	52.9	----
8	Kasaba	53.12	----
9	Venkatapura	46.1	----
10	Varadhenahalli	48.9	----
11	Bedarahalli	51.9	----
12	Kondenahalli	52	----
13	Abachikkanahalli	48.1	----
14	Agalakote	47.3	----
15	Akkupet	53.3	----
16	Anighatta	51.4	----
17	Binnamangala	49.3	----
18	Boovanahalli	53.2	----
19	Budigere	51.9	----
20	BudigereAmanikee	47.3	----
21	Kottigethimmanahalli	45.7	----
22	Chikkannanahosahalli	52.3	----
23	Chikkasanne	51.9	----
24	Gobbarakunte	47.3	----
25	Handrahalli	49.9	----
26	Hegganahalli	53.3	----
27	Holerahalli	48.3	----
28	Irigenahalli	47.9	----
29	Jonnahalli	51.5	----
30	Karahalli	46.6	----

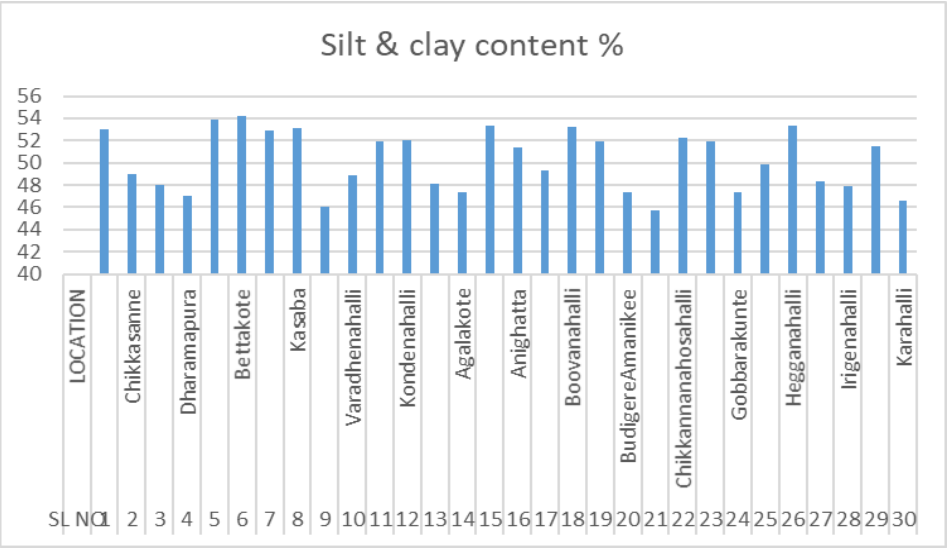

Fig.6 Test result of Silt& clay %

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Soil reaction (p^H)

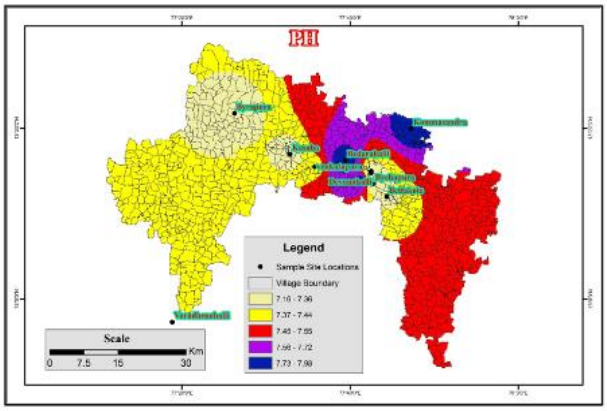

Fig.7 spatial varition map of soil reaction (Ph)

Salinity%

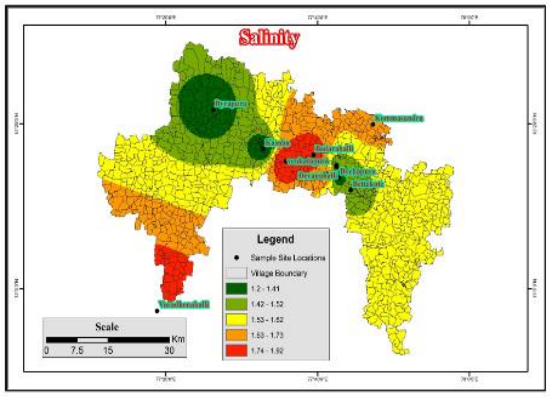

Fig.8 spatial varition mapofsoil Salinity%

silt and clay %

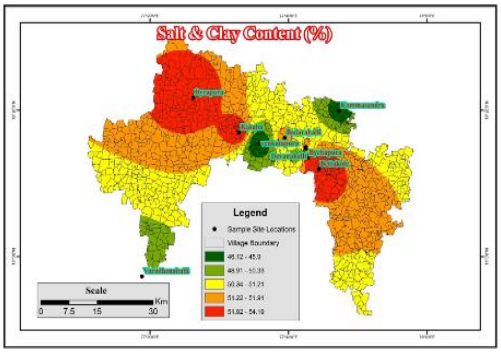

Fig-9 spatial varition of silt and clay %

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phosphorus (P2O5) kg/acre

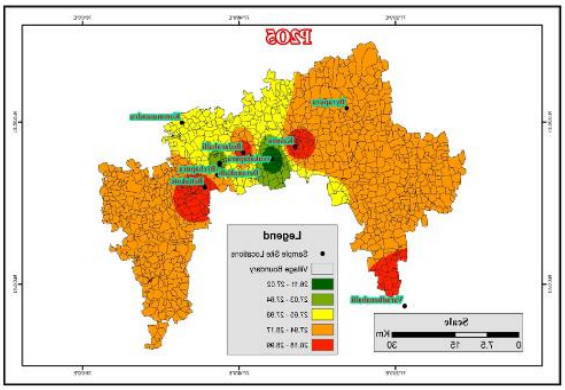

Fig.10 spatial variation of phosphorus (P2O5)

Electrical conductivity

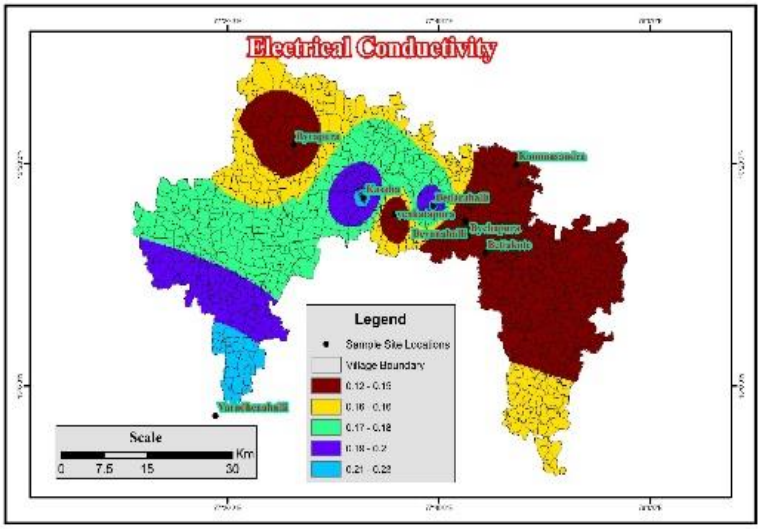

Fig.11 Spatial variation of electrical conductivity micro Siemens

DISCUSSION

The spatial data and attribute database was generated for the soil sample and was integrated for generation of spatial variation of maps of certain parameters like PH, Electrical conductivity, Moisture %, Salinity, Silt & clay % etc [19]. based on shape file obtained maps were created for the study area. This soil properties map helps to precision farming, environmental monitoring, extension workers, and also for decision makers at district and taluk level.

Table 4,5, 6&7 shows the results of soil properties Phosphorous, Electrical conductivity, Salinity & Organic carbon, Silt& clay [20].

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Spatial varition maps of soil properties of selected villages are shown in the figure.1 PH, figure.2 salinity, figure.3 silt and clay, figure.4 phosphorous, figure.5 electrical conductivity. All properties are represented in colour coding using arc GIS software. For various villages in devanalli. Which is clear that ranges are in represented in the each diagram so that will represented in different colour.

he pH level of 6.5 falls within the optimal range (6.0–7.5) for most plant growth. This slightly acidic to neutral pH supports nutrient availability, microbial activity, and overall soil health. It is ideal for a wide range of crops, including vegetables, grains, and ornamentals. For construction, neutral pH is beneficial as it reduces the risk of corrosion to underground infrastructure and supports vegetation in green landscapes.

At 4.2%, the organic matter is within the healthy range. Organic matter plays a key role in improving soil structure, moisture retention, nutrient supply, and biological activity. For farming and gardening, it enhances crop yields and plant vitality. From an environmental standpoint, high organic matter supports carbon sequestration and biodiversity. In construction, soils with adequate organic matter are easier to manage during landscaping and erosion control.

Nitrogen (N) is moderate, which is adequate for many crops but may require supplementation for high-demand crops like corn or leafy greens.Phosphorus (P) is high, which supports strong root development and early plant growth but may require monitoring to prevent environmental runoff into nearby water bodies.Potassium (K) levels are moderate and sufficient for maintaining overall plant health and resistance to stress.

The loamy texture combines sand, silt, and clay in balanced proportions, offering good aeration, water-holding capacity, and root penetration. Loamy soils are considered ideal for most agricultural crops and home gardens. Their stable structure also provides solid ground for construction purposes, especially when paired with well-drained conditions, which reduce the risk of waterlogging and foundation damage.

With a bulk density of 1.3 g/cm³, the soil exhibits good porosity and root penetrability. This supports healthy plant growth and ensures adequate air and water movement. For environmental applications, it promotes soil respiration and microbial life, while in construction, it suggests a compact but manageable soil base.

No harmful chemicals or heavy metals were detected, making the soil safe for human use in gardens and farms, as well as for environmental conservation projects. It also reduces liability and remediation costs in construction or land development.

CONCLUSION

- The PH range for all the villages soil sample is exceeded and is in the average of 7.3, this value is in normal range 6.3 to 8.3. The electrical conductivity is varies from 0.01 to 1 in normal range. The salinity value is also varies with in the range. The organic carbon is also within the normal range 0.51 to 0.75.
- The soil quality is suitable for the agricultural purpose and also for construction for tall buildings. The loamy texture, good organic matter content, and balanced pH provide a favorable environment for most crops and vegetables. Nitrogen levels may need slight augmentation, depending on the crop type, but overall fertility is high.
- The well-drained loamy soil with moderate bulk density is structurally stable, making it appropriate for foundations and landscaping. No contaminants were found, reducing environmental and health risks during development. The absence of contaminants and healthy organic matter levels suggest that the soil supports a stable ecosystem. It would be suitable for conservation projects, native plant restoration, and sustainable land management. Overall, this soil is versatile and high-quality, supporting a wide range of agricultural, construction, and ecological applications with minimal amendments.

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