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Importance of Soil Health and It's Estimation by Remote Sensing and GIS

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Abstract: ***The soil quality is defined as the measurements of an essential organic and moving composition. To conserve the environment boundary with human health as well as to maintain the soils productivity are the main objective. In order to understand, it is important to differentiate between the soil heath and soil quality. The soil functions are generally related to soil quality however the living and organic stocks are of a non renewable resources, reutilizing the nutrients is presented by the soil health. Among this the Soil Organic Carbon is most important factor. In the soil SOC plays an important role in the productivity of the soil. In this research we conducted a study on the District of Farrukhabad, Uttar Pradesh by using Remote Sensing. A Sentinel-2 data has used for the analysis of Land Use and Land Cover purposes. The result concluded the highest and minimum measurement of SOC in Agricultural and waste land respectively.***
The main objective of this research, to describe the quality and characteristic of the soil and consider the reasons by which the soil quality get disturb, to discover the agricultural practices which directly affects the soil quality.
Keywords: Remote Sensing, Soil Quality, Soil Health, Productivity, Nutrients, Land use.

I. INTRODUCTION

For human beings soil, water and air are the essential natural resources. The concept of soil quality further elaborated as soil health is still evolving with soil quality legislations framed as far only in a few countries. (FILIP 2002, NORTCLIFF 2002). Since last few years the concept of quality and health of soil is enhancement is increases. In the characteristic and condition of soil, soil organic carbon is an important element. The multiuse of soil has become popular globally. By spatial distribution over an area of soil organic carbon, pH and electrical conductivity content an estimated productivity of the soil can easily examine. By examine different soil properties test the quality of soil over an area on different agricultural management practices can be found easily.

II. SOIL COMPONENT

In order to understand health and quality of the soil in agricultural practices first we need to understand the composition of the soil. The soil composed of different types of particles which are generally formed by Soil-formation process. Different type of soil particles joints together and forms some spaces known as pores; between them. When these pores filled with water then the soil becomes fully saturated, however soil becomes Dry when the pores filled with an air. On the basis of different particles size, soils form the different textures.

Fig-01 Components of soil

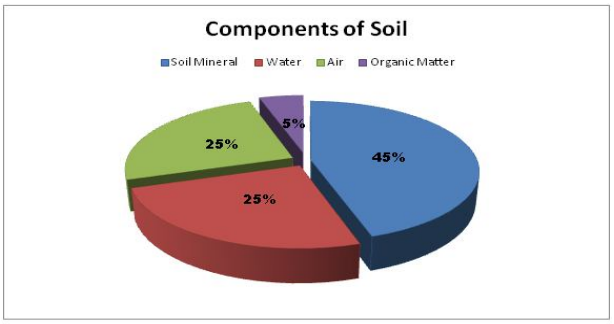
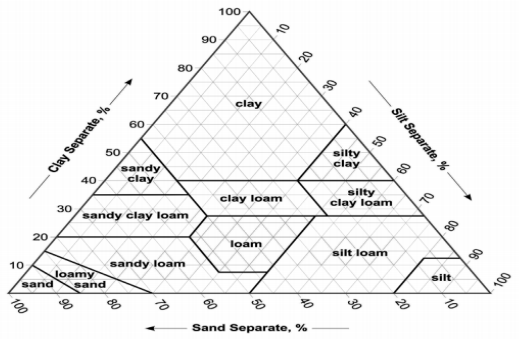


Fig-02 Soil textural triangle



Soil textural triangle (Fig-02) used for determining soil texture if the percentages of sand, silt, and clay are known (source: USDA Natural Resources Conservation Service).

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Soil characteristics	Relationship to soil condition or function	Rationale for selection as priority measurement
Physical Characteristic		
Soil texture	Retention and transport of water and chemical	Process modelling, erosion, and productivity estimates
Profile, topsoil and rooting depth	Productivity and erosion estimates	Normalization of landscape and geographic variables
Bulk density and water infiltration1	Leaching, productivity, and erosive estimates	Physical characteristics and for adjustment of measurements to volumetric basis
Water retention capacity	Water retention, transport, and erosivity	Water available for plant and microbial processes
Chemical Characteristics		
Total organic C and N	Soil fertility, stability and erosion status	Process modelling and normalization of site characteristics
pH	Biological and chemical activity thresholds	Process modelling
Electrical conductivity	Plant and microbial activity thresholds	Productivity and environmental quality indicators
Extractable N, P, and K	Potential N loss and plant available nutrients	
Biological Characteristics		
Microbial biomass C and N	Microbial catalytic potential and capacity for C and N retention	Process modelling and early indicator of adverse practices affecting soil organic matter content
Potentially mineral N		Process modelling and surrogate indicator for microbial biomass
Soil respiration, water	Microbial and sometimes plant content and temperature1 activity	Process modelling and estimate of microbial biomass activity

In the given table Soil physical, chemical, and biological characteristics proposed by Dorul and Parkin (1994) as basic indicators of soil quality.

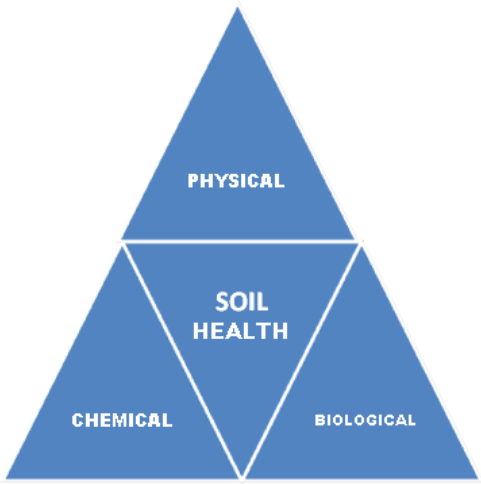


Fig-03 Composition of Soil Health

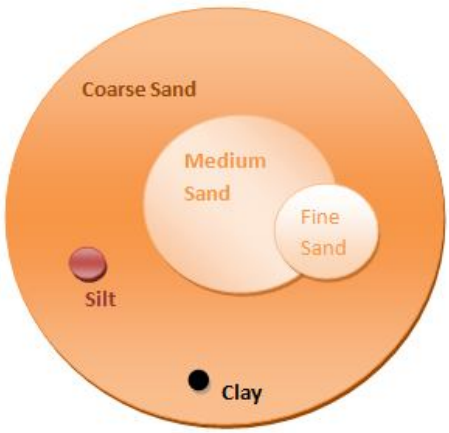


Fig-04 Particle size

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Importance of Soil Organic Carbon	Factors affecting Soil Organic Carbon
Soil nutrients	Climate.
Soil Structure	Soil Type
Soil Biology	Soil Moisture
Soil Protection	Plant Productivity
	Management Effects

Fig-05

III. OBJECTIVE

To determine Soil Organic Carbon content in the Farrukhabad district of UP. To made a spatial distribution over entire area of the parameter with the help of Remote Sensing and Geo-spatial Techniques.

IV. SOURCE OF SOIL ORGANIC CARBON

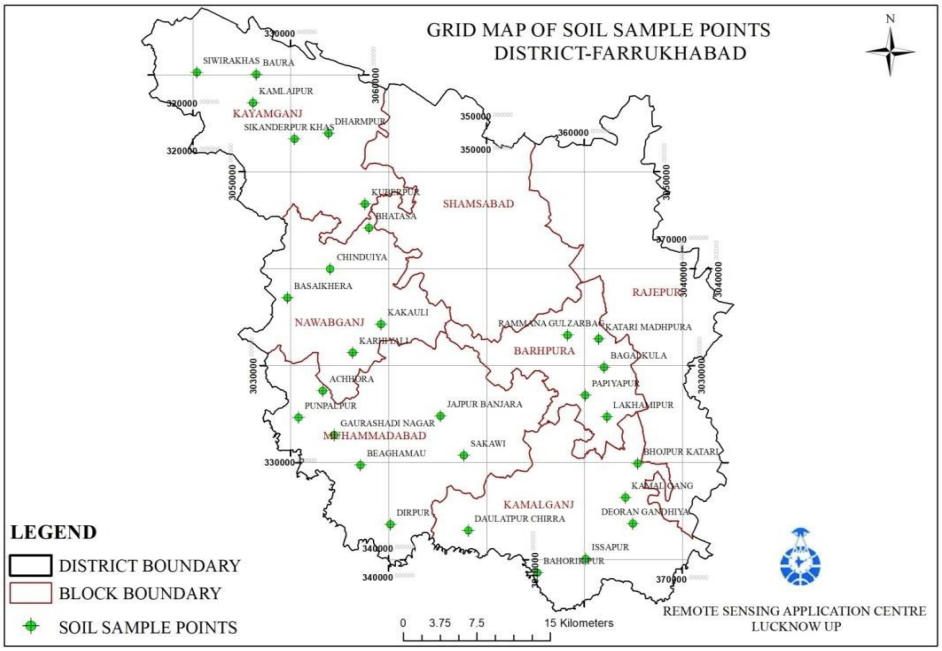
Land-based organic carbon is derived from plant production. Plants use sunlight and atmospheric carbon dioxide (along with water and soil nutrients) to grow and generate sugars and organic plant tissue through the process of photosynthesis. This organic material is then consumed by other organisms through the food chain and is excreted or dies and decomposes.

The organic material that is produced along the way either decays to produce water and carbon dioxide. The carbon component of this soil organic matter then becomes soil organic carbon. Soil organic carbon is one part of soil organic matter, together with hydrogen, oxygen, nitrogen, phosphorus and sulphur.

V. STUDY AREA

Farrukhabad is a district of Uttar Pradesh state in Northern India. The town of Fatehgarh is the district headquarters. The district is part of Kanpur Division. Farrukhabad is situated between Lat. 26°46' N & 27°43' N and Long. 79°7' E & 80°02' E. The district is bounded by Badaun and Shahjahanpur on the north, Hardoi district on the east, Kannauj district on the south, and Etah, Mainpuri districts on the west. The Ganga river and Ramganga river are located to the east and the Kali river to the south.

Fig-06 Sampling Points



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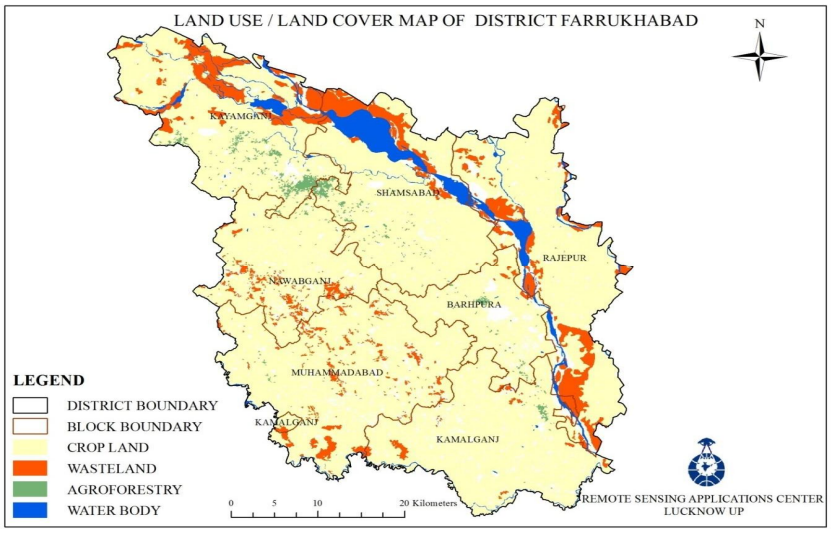


Fig-07 Land use map of Farrukhabad

The above map shows the land use / land cover map of the study area. Most area was cover with agricultural practices, which makes the area agricultural dominated. The distribution of each category along with the cropping system and area covered is given below in table.

Land use type	Description	Area (ha)	Area coverage
Crop Land	Wheat, Potato, Paddy Maize	170969.12	78.53%
Waste Land	Scrub Land ,Sodic Land	18769.56	8.62%
Forest	Shisham, Babool	0	0%
Agro forestry	Mango, Guawa, Awola,	2364.32	1.08%
Total		192103	88.23

Table-01 Relative Distributions by Land Use type

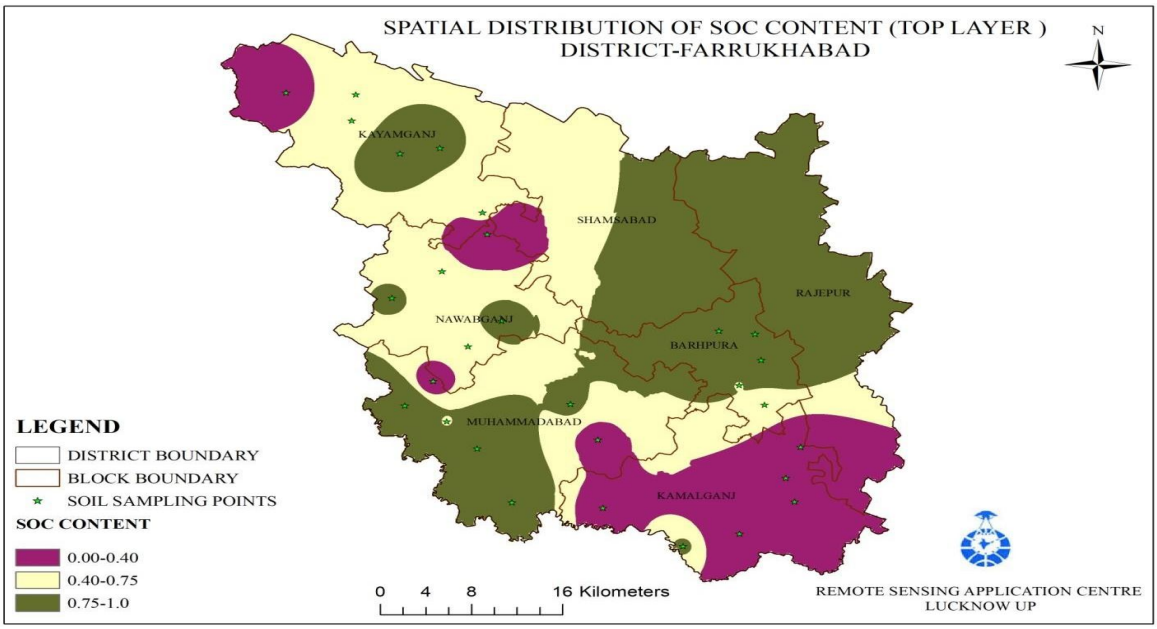


Fig-08 Spatial distribution of Soil Organic Carbon

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VI. CHARACTERISTIC OF A HEALTHY SOIL

Following some main characteristics of a healthy soil is given below-

A. Depth of Soil.
B. Soil Tilth.
C. Water Holding Capacity.
D. Good Drainage Property.
E. Nutrients Availability.
F. Less Weed Coverage.
G. Less Active Insect Pests.
H. Active Organisms.
I. Free of Chemical and Toxins.
J. Derogation Resistant.

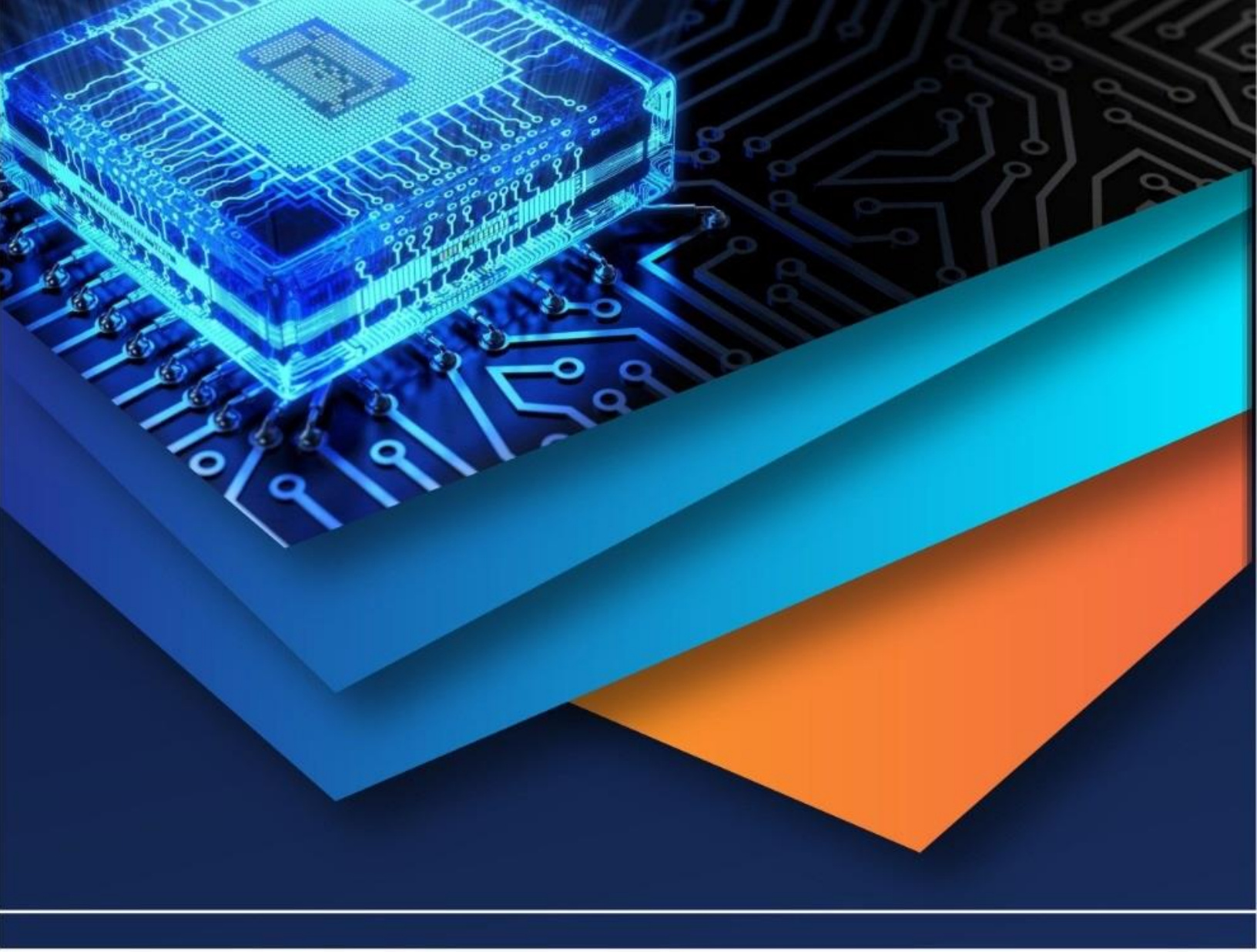
VII. RESULT OR CONCLUSION

The type of land use and land cover identified in the area are Crop land of 78.53%, Waste Land 8.62%, Forest 0%, Agro Forestry 1.08%. By examine laboratory test result of soil samples from different land use types by using Wet Combustion method the Soil Organic Carbon, the distribution of SOC content shown in fig-08. This is done with the help of Arc map 10.2.2 software by IDW (Inverse Distance Weighting) method. The agricultural based system recorded the highest values, the form based system and waste land recorded low values of SOC content. Therefore in the carbon distribution map, the agricultural based systems showed the high color intensity while the waste land and crop land showed low color intensity.

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