KHEOBSDAY2024

Topic: Environmental Variables Determining Carbon Stock and Soil Physical Properties at the catchment Scale, Stung Chrey Bak Observatory, Cambodia

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Introduction

1.Soils

Important of soils
1.Biodiversity
2. Carbon Sequestration
3.Plant Growth
4.Nutrient Cycling

Soil Carbon
1.Climate changes Mitigation
2. Soil Fertility and Productivity
3. Water management
4.Biodiversity Support

2.Soil Properties

Soil physicals Properties:
1. Bulk Density
2. pH
3.Eletrical Conductivity

3.Soil Carbon

Problem Statement

Soil Carbon depleted:
- intensive Agriculture
- Climate changes
- Wild Fires
- Land use changes
- Green house Emission

Soil Structure distrupted:
- Soil aggregation and carbon stabilization
- Compaction reduced porosity
- Erosion
- Soil degradation

Soil pH imbalances:
- Soil microorganisms
- Stabilization of soil organic matter
- Effected plant growth

objective

"**Understanding the current state of soil carbon and to disentangle the environmental factor(e.g, land use changes over time from 1952 to the current situation, soil geology, topography, distance to the river, steam house hold), explaining the variability in soil properties observed at the scale of watershed in Tonle Sap Region**"
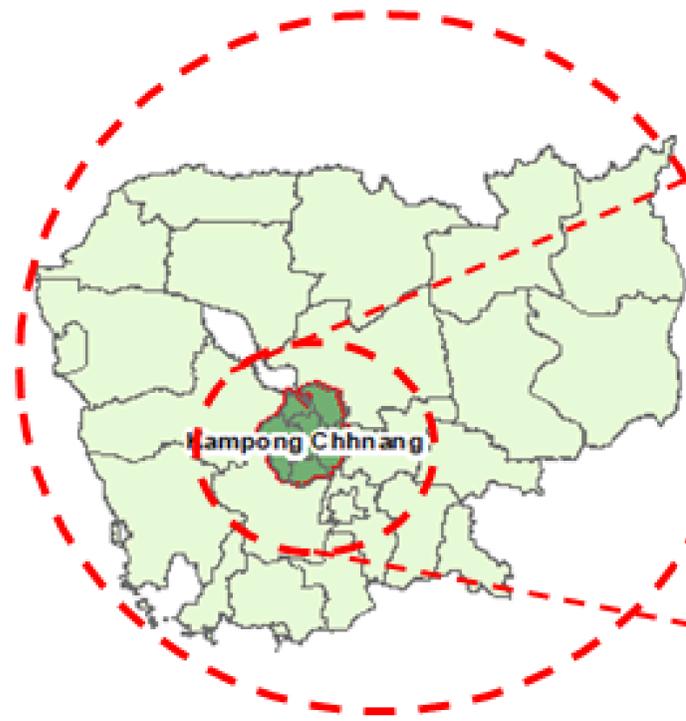
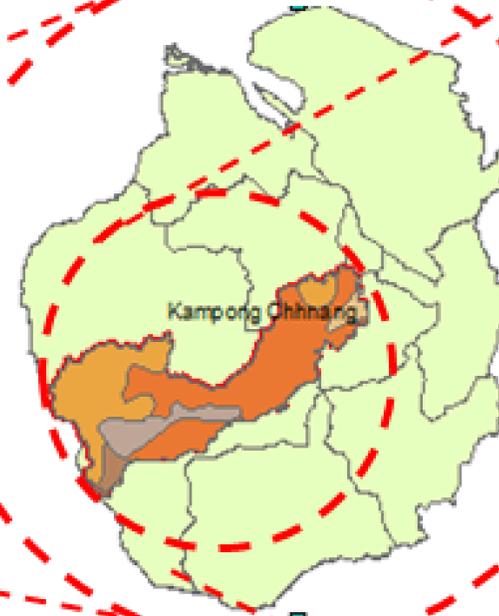# Methodology

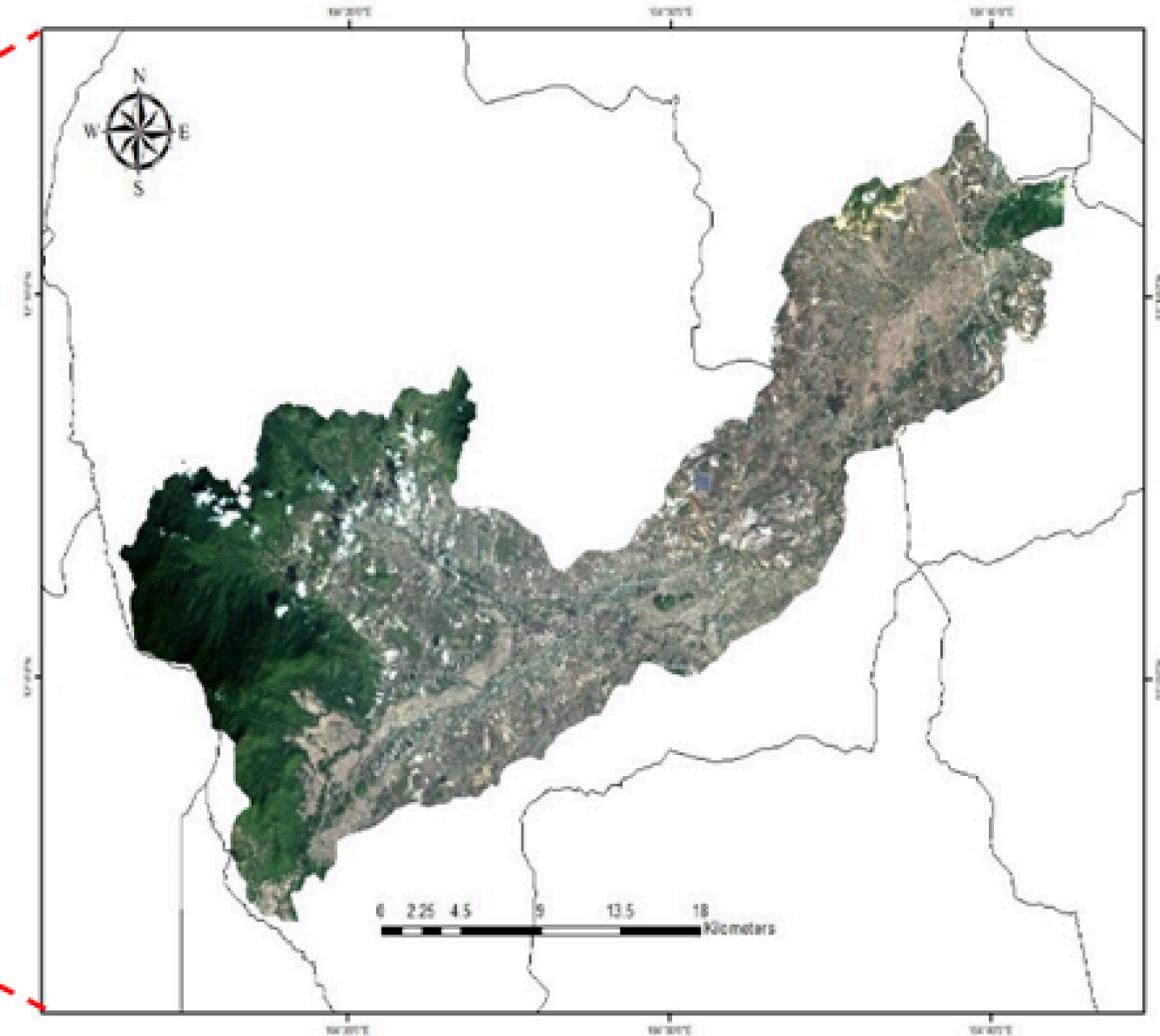1.Lab Sample Experiment
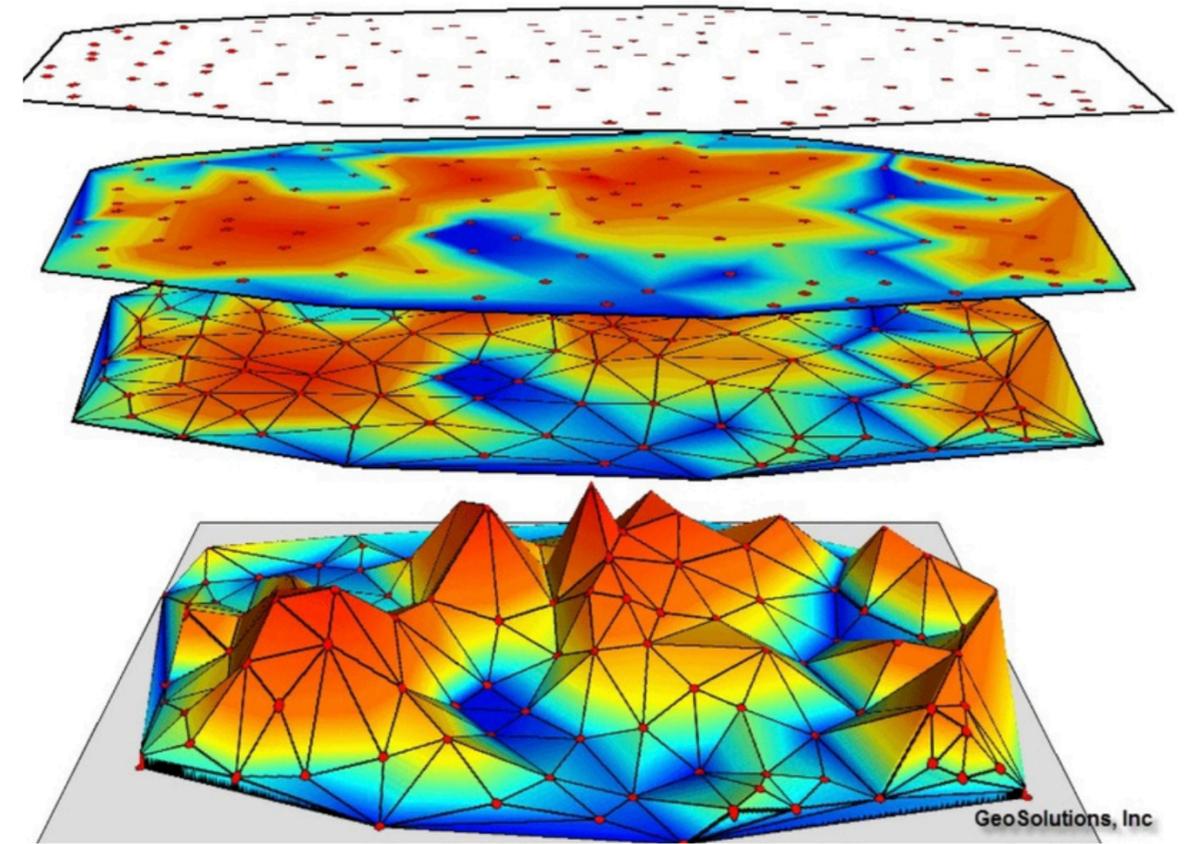
2.Digital Mapping

Study Area

Kampong Chnang, Cambodia

Chrey Bak catchment

Soil Sampling

Chrey Bak catchment

Land cover as of 1981

Legend

50Point Sampling
- Dense forest
- Clear Forest
- Rice fields
- Brush Wood
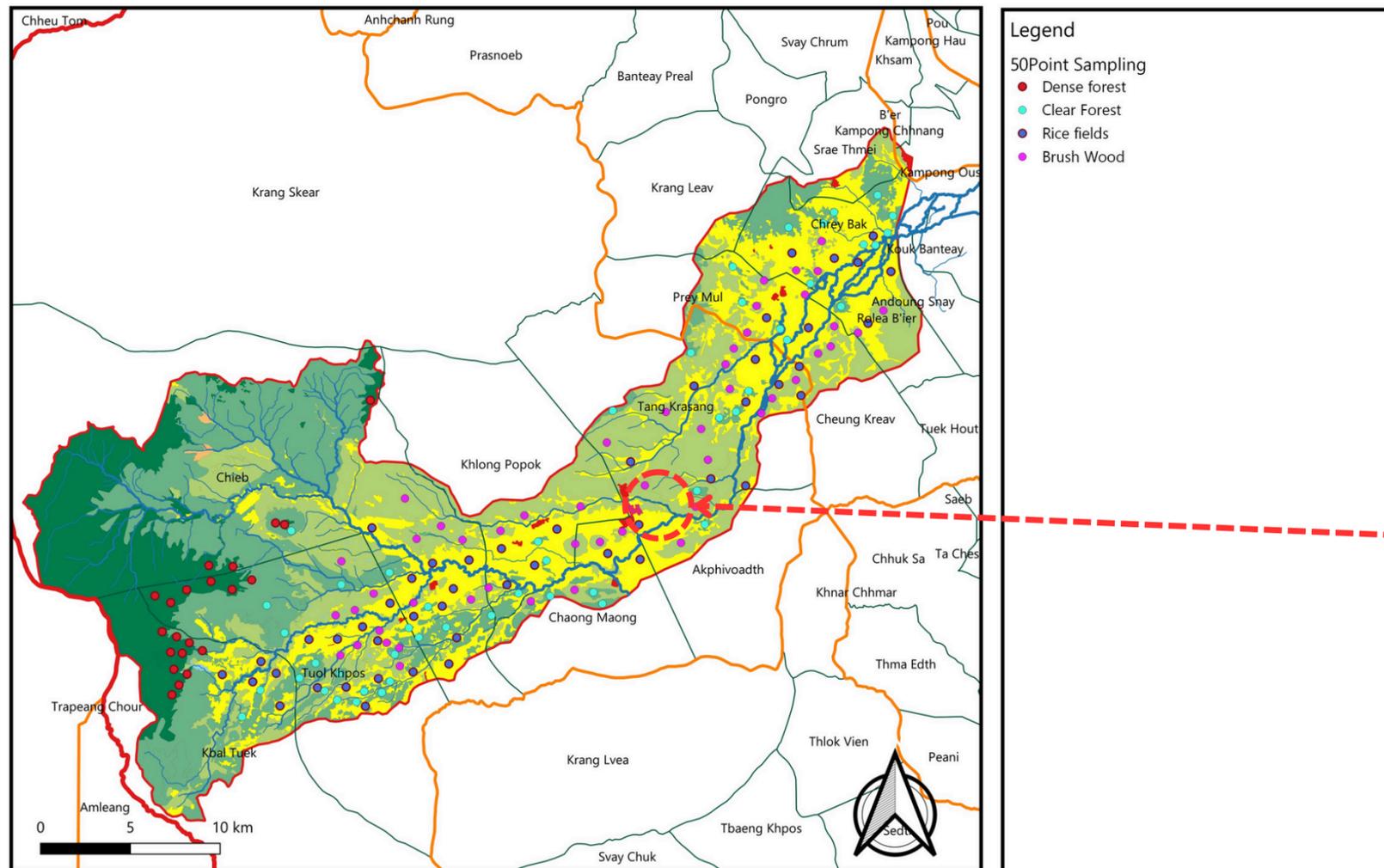
Source:

Cartography:

The soil sampling was conducted on 20th November 2023 at Stung Chrey Bak.
Soil samples were collected from the topsoil for the first layer (0-5 cm depth) and second layer (20- 30cm).
Collected 100g for 2 layers and bulk density.

Bulk Density

Weight Sample → Oven (105C, 24h) → Weight Sample
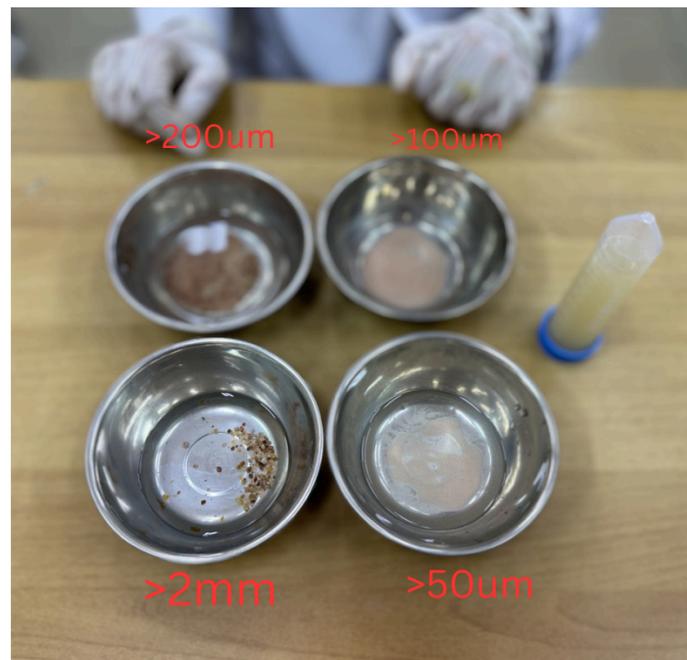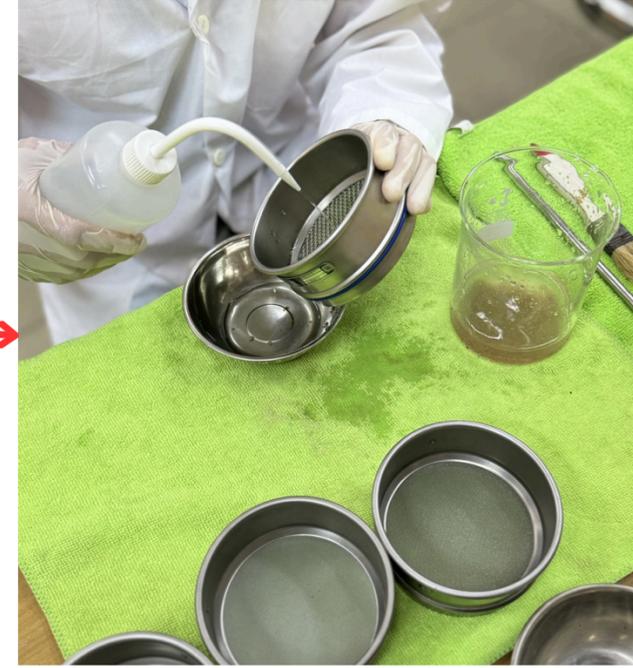
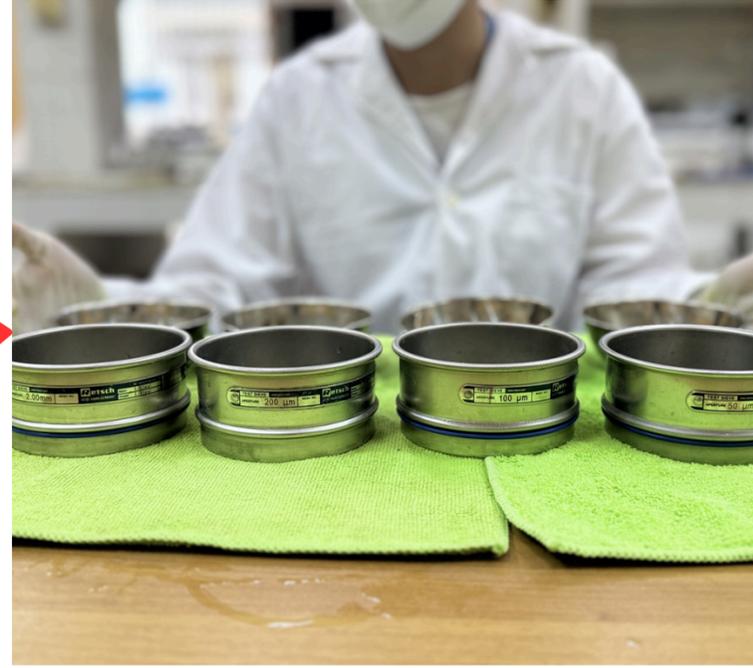Calculated Bulk density → Bulk density is defined as: $\rho = \frac{mass\ of\ dry\ soil\ (g)}{volume\ of\ ring\ (cm3)}$ Eq. 1

HANNA INSTRUMENTS PH METER SOIL pH and Eletrical Conductivity

Weight Sample(10g) → 25ml of distrilled water → Stirring 1 minute → Settle For 2h

Pre treatment
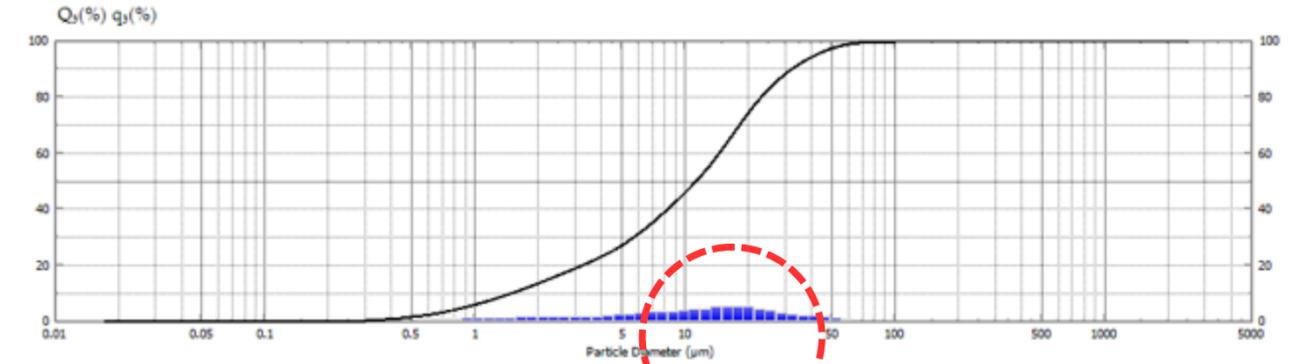

>200um   >100um

>2mm   >50um

- Weight 10g of Soil
- 5ml of Hydrogen Peroxide
- 5ml of distilled water
- Put 60 degrees in hotplate
- put it in the oven 105c degrees
- Put NaPO3 and Ultrasound
- sieving: >2mm, >200µm,>100µm,>50µm and the mixed well solution <50µm and put it in the bottle
- analysis in the machines.

Particle Size

- Instrument Set Machine
- Sample Preparation
- Sample Laoding
- Measurment Setting
- Data Acquisition
- Data Analysis
- Size Calculations
- Result Interpretation

e Name	RP2_L1-0001				Meas Date	2024/04/24 10:23:49(+0700)
ample ID	RP2_L1		Sample No.	1		
mment						
edian D	11.107	Mean V	8.611	Absorbance	0.125	
odal D	14.994	Std Dev	0.509			

25.000 %D	50.000 %D	75.000 %D	0.000 %D	0.000 %D	0.000 %D	0.000 %D	0.000 %D	0.000 %D
4.366	11.107	20.162	0.000	0.000	0.000	0.000	0.000	0.000

Diam x(μm)	Cum% Q3(%)	Diff% q3(%)		Diam x(μm)	Cum% Q3(%)	Diff% q3(%)		Diam x(μm)	Cum% Q3(%)	Diff% q3(%)		Diam x(μm)	Cum% Q3(%)	Diff% q3(%)
######	100.000	0.000	27	113.342	100.000	0.000	53	5.139	28.028	2.346	79	0.233	0.114	0.073
######	100.000	0.000	28	100.628	100.000	0.020	54	4.562	25.682	2.077	80	0.207	0.042	0.032
######	100.000	0.000	29	89.339	99.980	0.056	55	4.050	23.605	1.828	81	0.184	0.009	0.009
######	100.000	0.000	30	79.317	99.924	0.194	56	3.596	21.777	1.679	82	0.163	0.000	0.000
######	100.000	0.000	31	70.419	99.730	0.413	57	3.193	20.098	1.638	83	0.145	0.000	0.000
######	100.000	0.000	32	62.520	99.317	0.710	58	2.834	18.460	1.591	84	0.129	0.000	0.000
######	100.000	0.000	33	55.506	98.607	1.121	59	2.516	16.869	1.587	85	0.114	0.000	0.000
######	100.000	0.000	34	49.280	97.487	1.502	60	2.234	15.282	1.543	86	0.101	0.000	0.000
965.030	100.000	0.000	35	43.752	95.984	1.885	61	1.984	13.739	1.476	87	0.090	0.000	0.000
856.773	100.000	0.000	36	38.843	94.099	2.289	62	1.761	12.263	1.408	88	0.080	0.000	0.000
760.661	100.000	0.000	37	34.486	91.811	2.670	63	1.563	10.856	1.330	89	0.071	0.000	0.000
675.330	100.000	0.000	38	30.617	89.141	3.182	64	1.388	9.525	1.254	90	0.063	0.000	0.000
599.572	100.000	0.000	39	27.183	85.959	3.841	65	1.232	8.271	1.180	91	0.056	0.000	0.000
532.312	100.000	0.000	40	24.133	82.118	4.426	66	1.094	7.091	1.093	92	0.050	0.000	0.000
472.597	100.000	0.000	41	21.426	77.692	5.124	67	0.971	5.998	0.998	93	0.044	0.000	0.000
419.582	100.000	0.000	42	19.023	72.568	5.409	68	0.862	5.000	0.894	94	0.039	0.000	0.000
372.513	100.000	0.000	43	16.889	67.159	5.387	69	0.766	4.106	0.777	95	0.035	0.000	0.000
330.725	100.000	0.000	44	14.994	61.772	5.157	70	0.680	3.329	0.666	96	0.031	0.000	0.000
293.624	100.000	0.000	45	13.312	56.615	4.540	71	0.604	2.663	0.550	97	0.027	0.000	0.000
260.685	100.000	0.000	46	11.819	52.075	4.153	72	0.536	2.112	0.456	98	0.024	0.000	0.000
231.442	100.000	0.000	47	10.493	47.922	3.841	73	0.476	1.656	0.376	99	0.022	0.000	0.000
205.479	100.000	0.000	48	9.316	44.081	3.603	74	0.422	1.280	0.315	100	0.019	0.000	0.000
182.428	100.000	0.000	49	8.271	40.478	3.507	75	0.375	0.965	0.280	101	0.017	0.000	0.000
161.963	100.000	0.000	50	7.343	36.971	3.284	76	0.333	0.685	0.236				
143.794	100.000	0.000	51	6.519	33.687	2.978	77	0.296	0.449	0.193				
127.664	100.000	0.000	52	5.788	30.710	2.682	78	0.262	0.256	0.142				

ndition File Name

The result of the soil<50um

ASD Labspec 5000
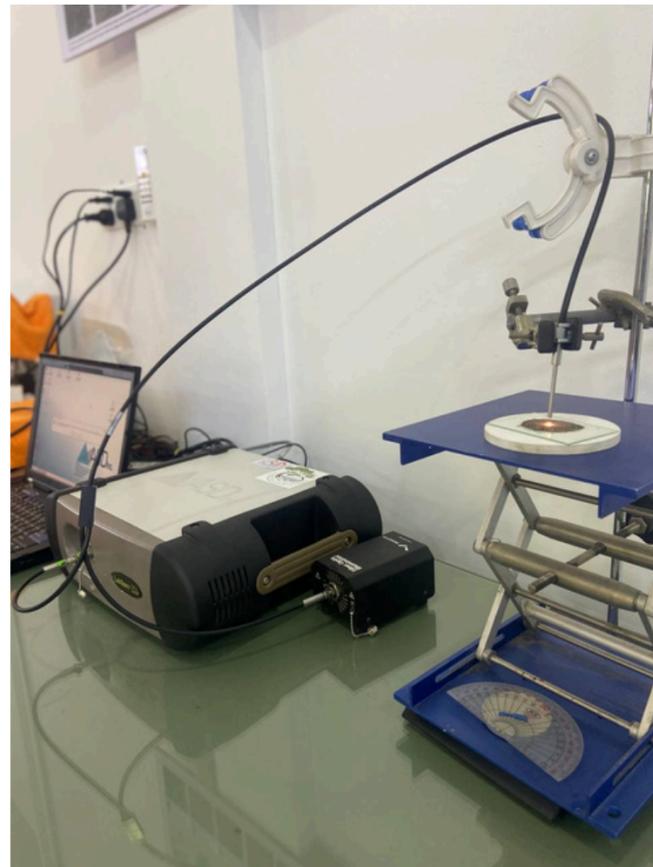
Sample Preparation → Sample Placement → Data Processing → Interpretation and Quantitively analysis Data

Analyse Spataial Interpolation

Data Colletion

↓

Data Processing

↓

Interpolation IDW Method

↓

Generating the interpolation Map

↓

Visualizing the Interpolations Map

↓

Evaluation and Validation
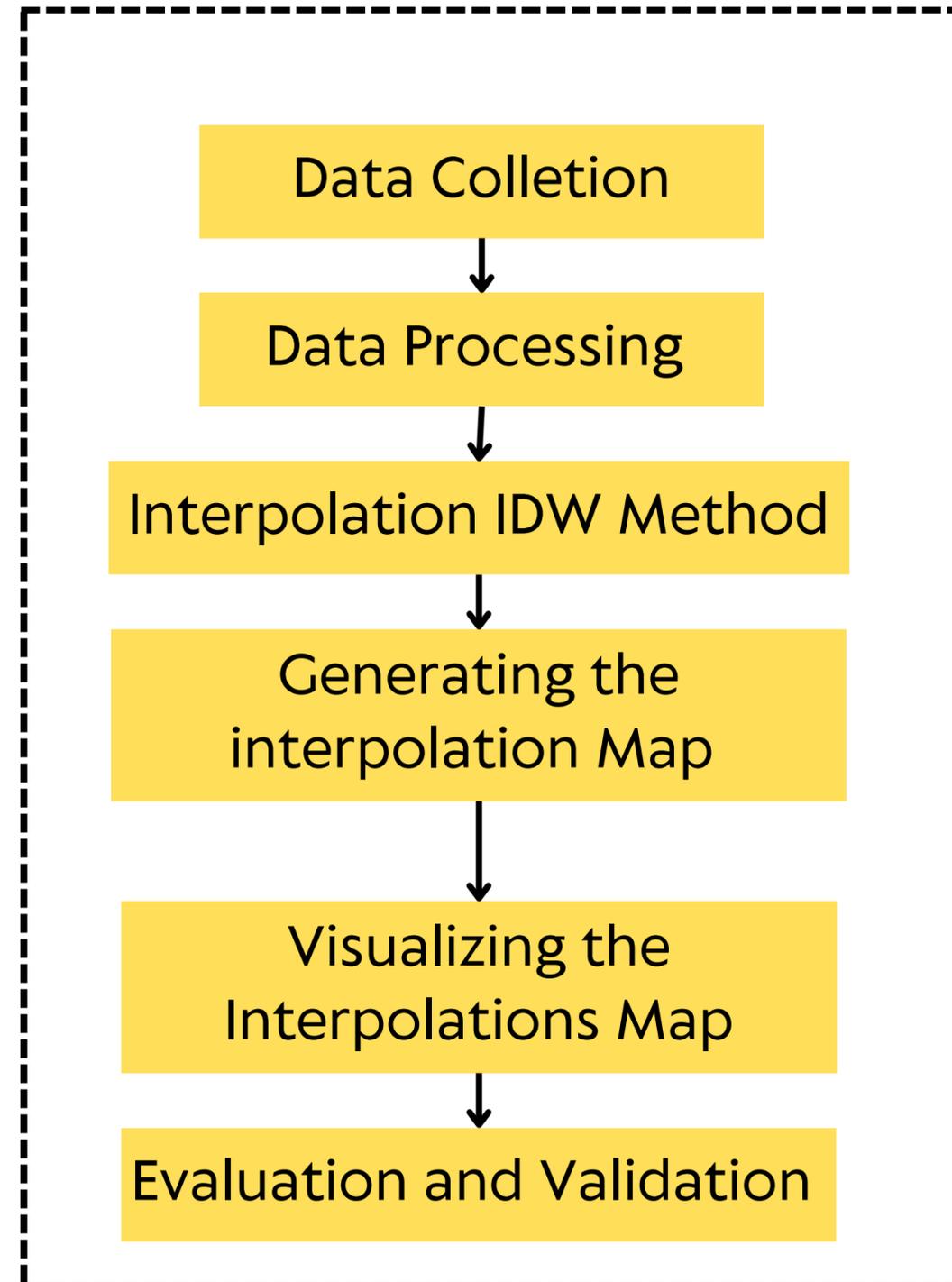
Data Analysis

"The effects of four land uses on soil properties were analyzed .
Collected data in this study were analyzed and examined statistically using analysis of Shapro test. The Shapiro-test for normality is one of three general normality tests designed to detect all departures from normality. It is comparable in power to the other two tests. The test rejects the hypothesis of normality when the p-value is less than or equal to 0.05."

The result of the averages value ranged from four types are 1.28g/cm^3, 1.68g/cm^3, and 1.67g/cm^3 and 1.66g/cm^3
It was significantly different but not much different.
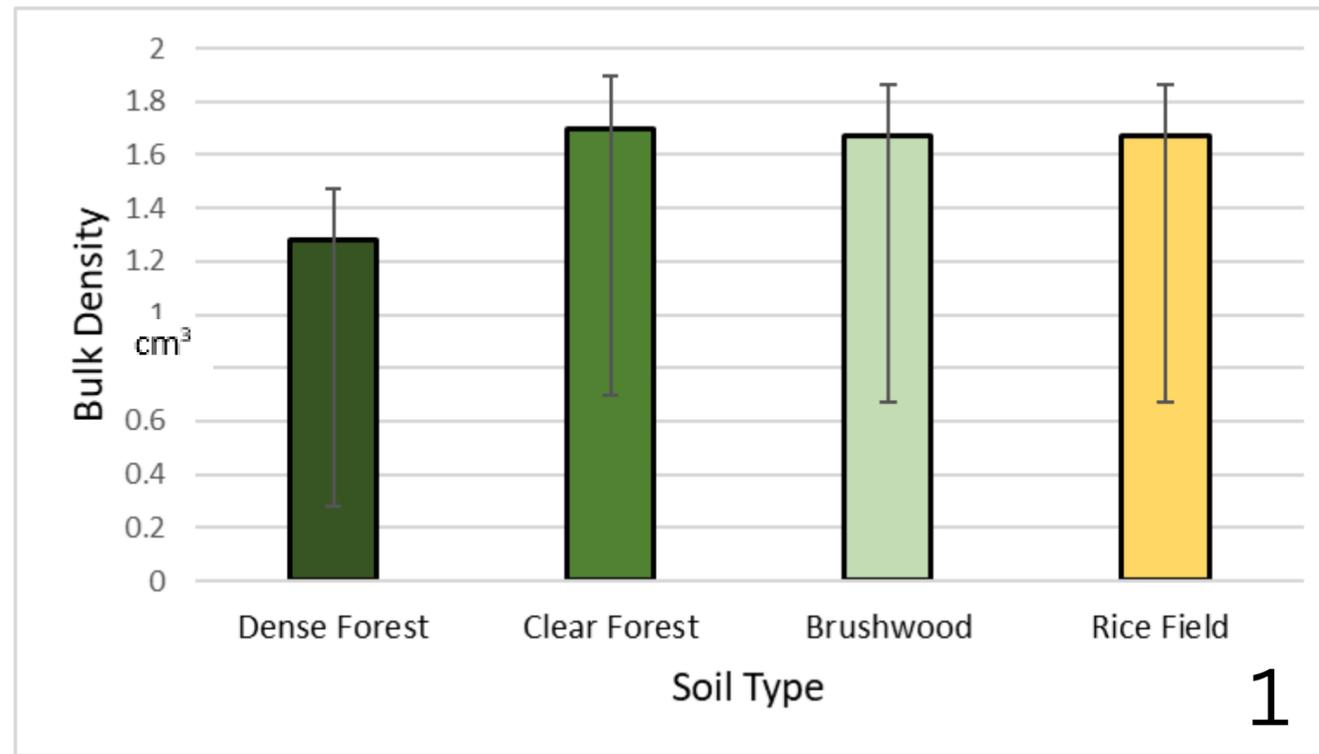
The result of averages values ranged from Second Layer layers are 1.48g/cm^3 and 1.55g/cm^3 and 1.56g/cm^3
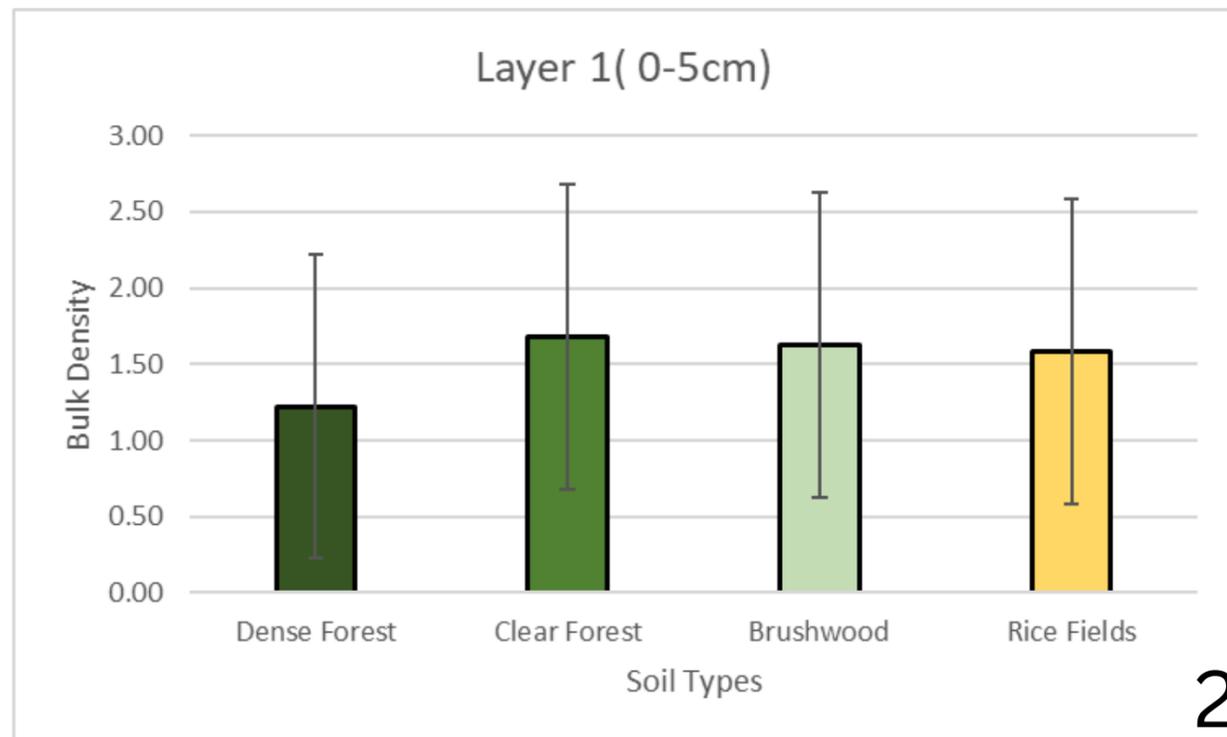
The result of averages values ranged from first layers are 1.31g/cm^3 and 1.52g/cm^3 and 1.54g/cm^3
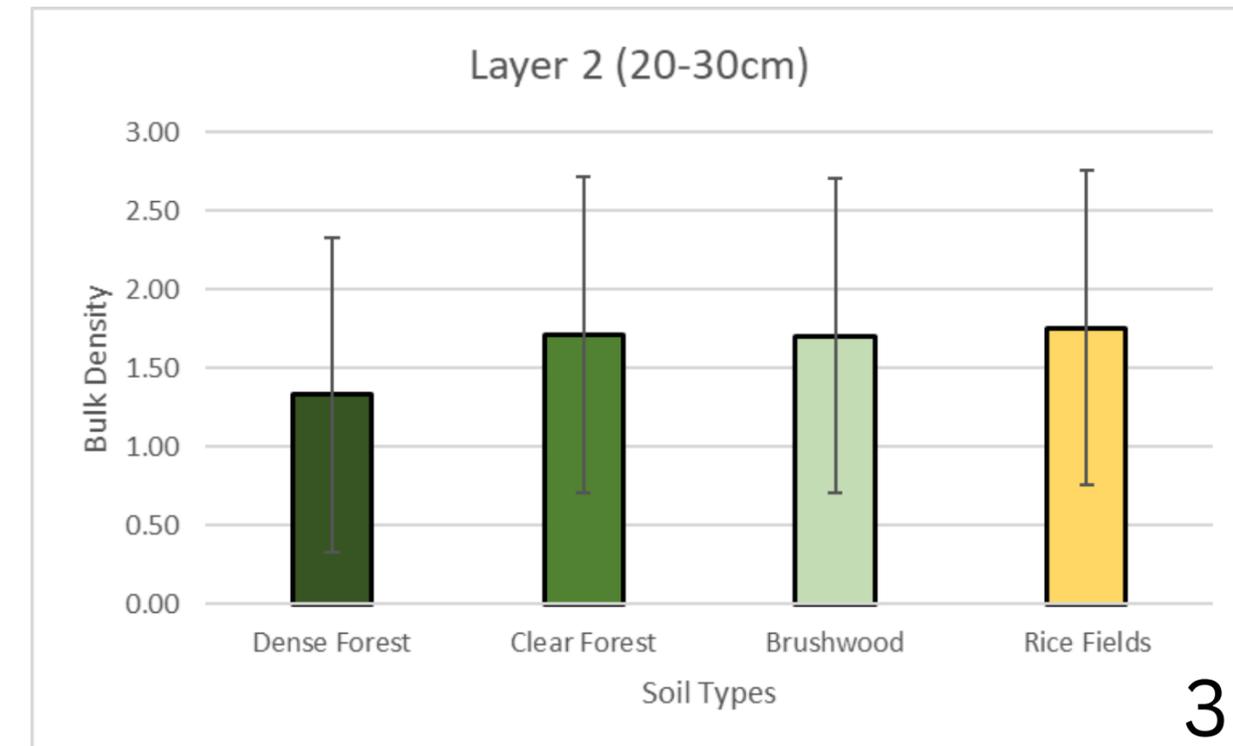
Normal Q-Q Plot

Histogram with Normal Curve

L1_L2

P_Value is 1.521e-07
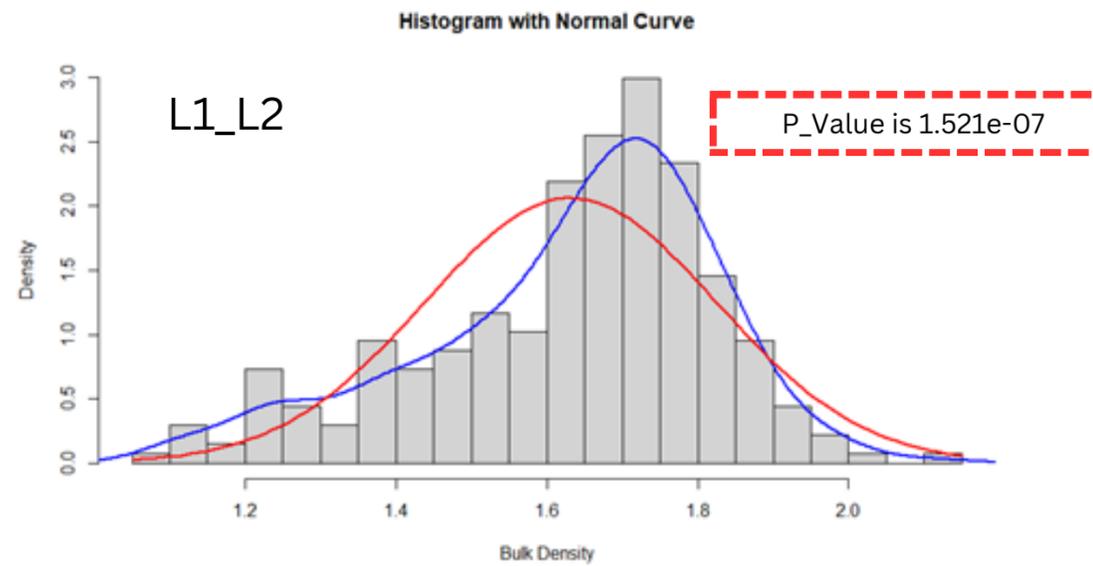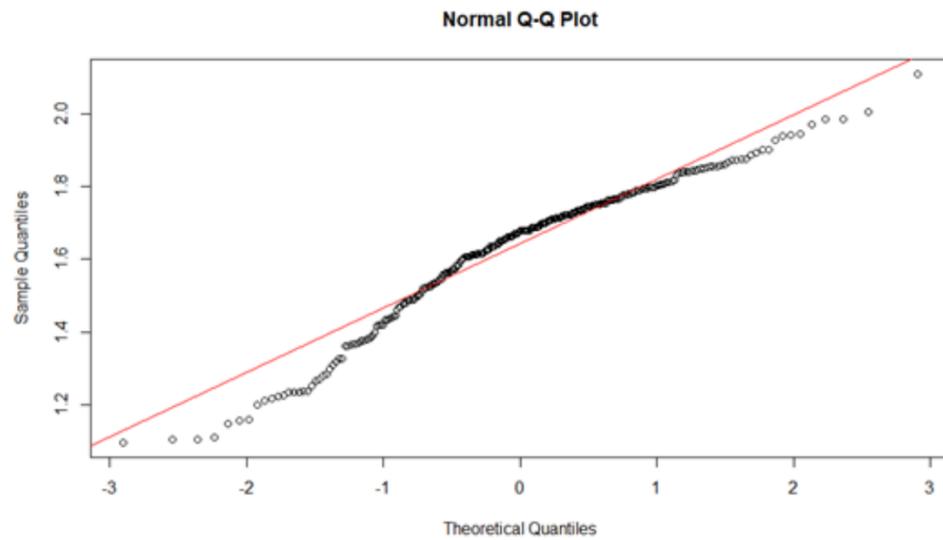
The scatter plot show the relationship between bulk density of different four types of soils.The distribution of the data points appears to be fairly linear, suggesting a linear relationship between bulk density and land use types of soil.

Normal Q-Q Plot

Histogram with Normal Curve

L1

P_Value is 0.0004433

Since the p-value is less than 0.05, you reject the null hypothesis. This suggests that the data significantly deviates from a normal distribution and it is really visible to the 2 graphs.

Normal Q-Q Plot

Histogram with Normal Curve

L2

P_Value is 2.199e-06
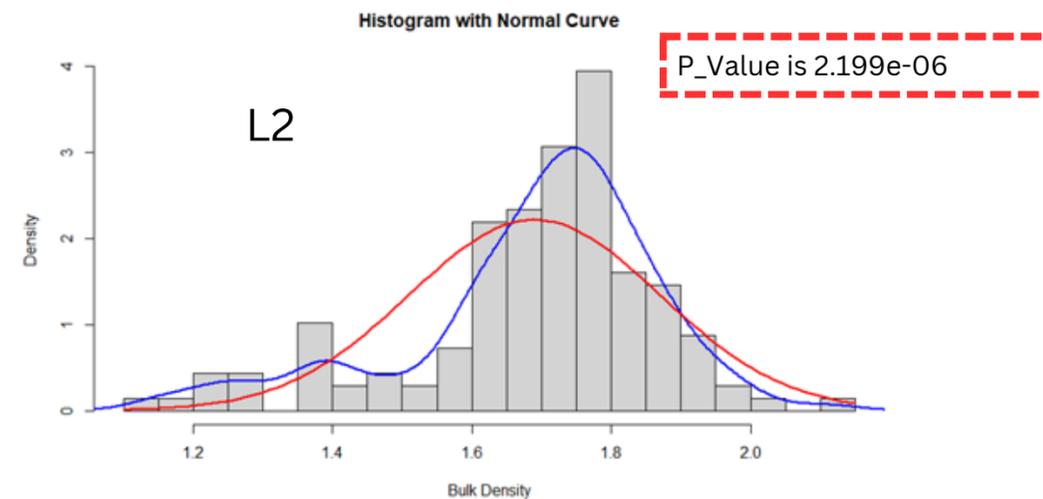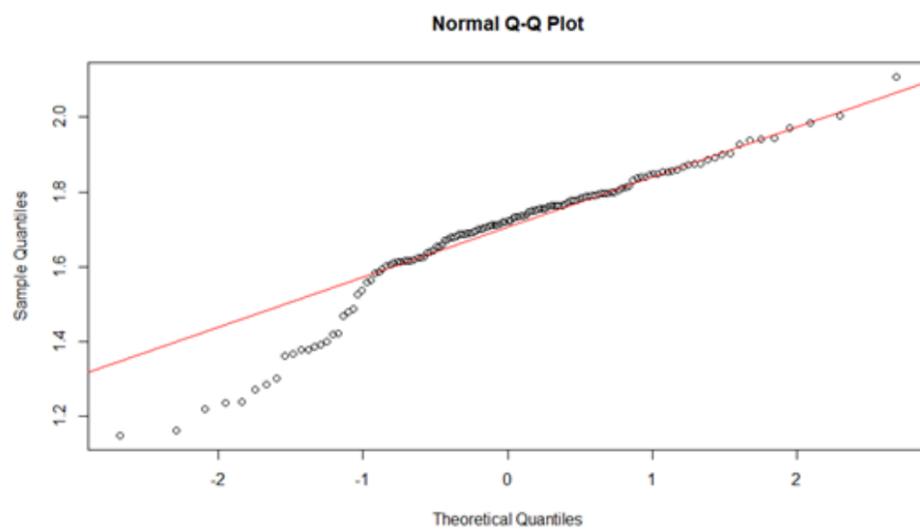
Result and Discussion (pH)

The study presented the pH values ranged from 6.43, 6.02,6.04 and 5.86.One more thing, the pH of the soils in the four land use types is grouped under the acidic (5.86- 6) class.
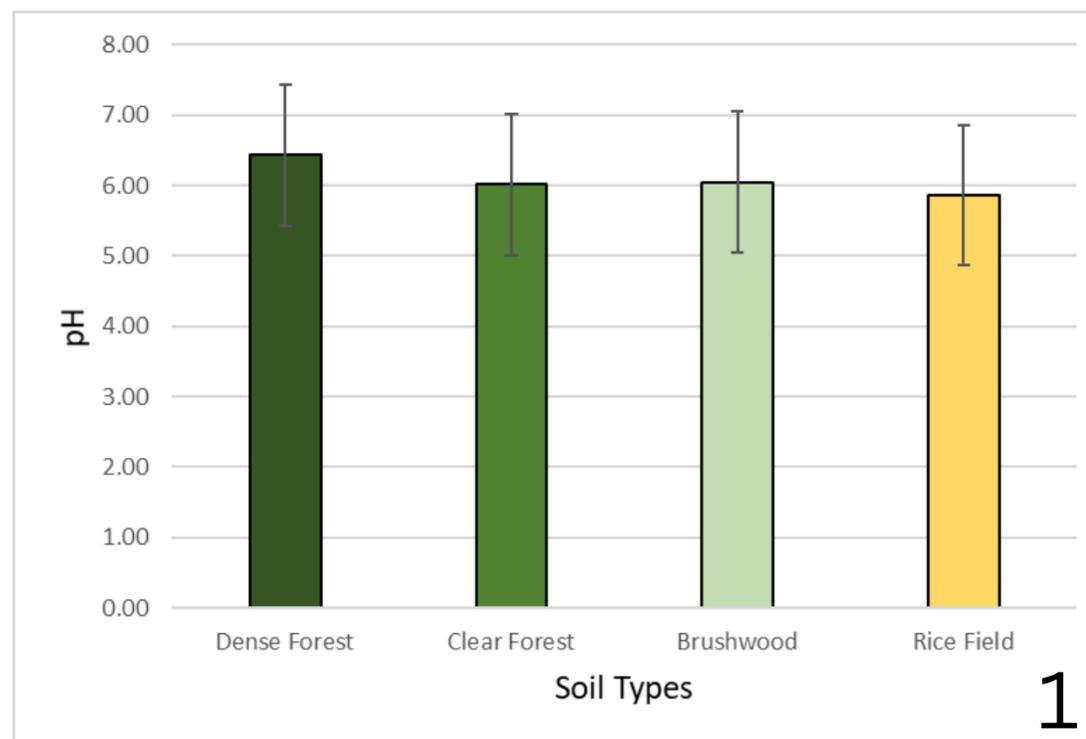
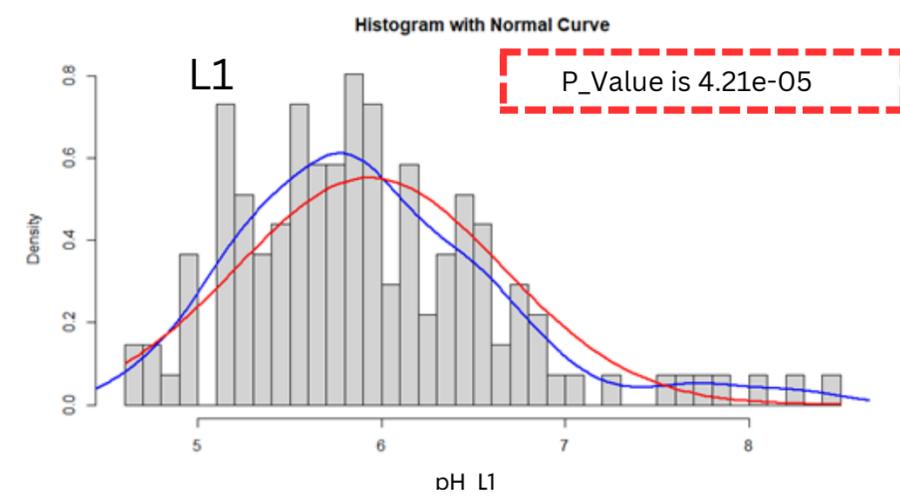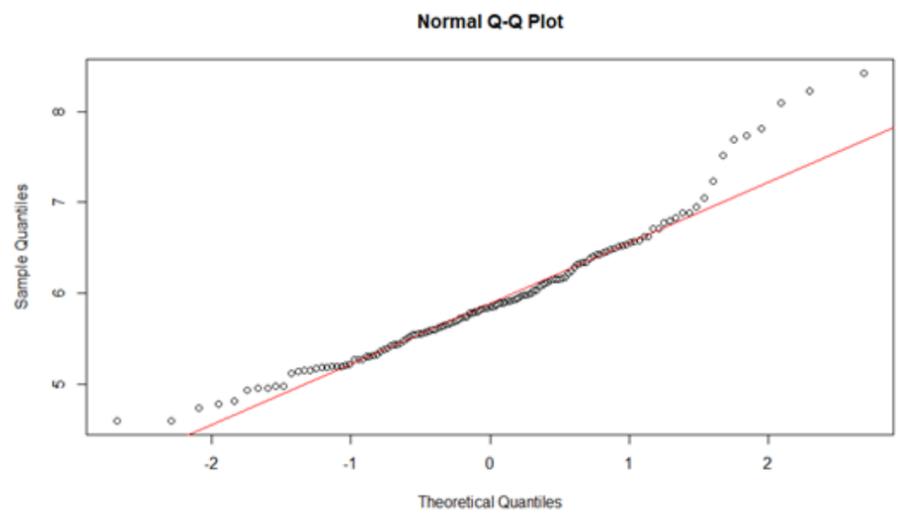The range of the pH values ranged second layers from6.41, 5.91,6.12,and 5.96.
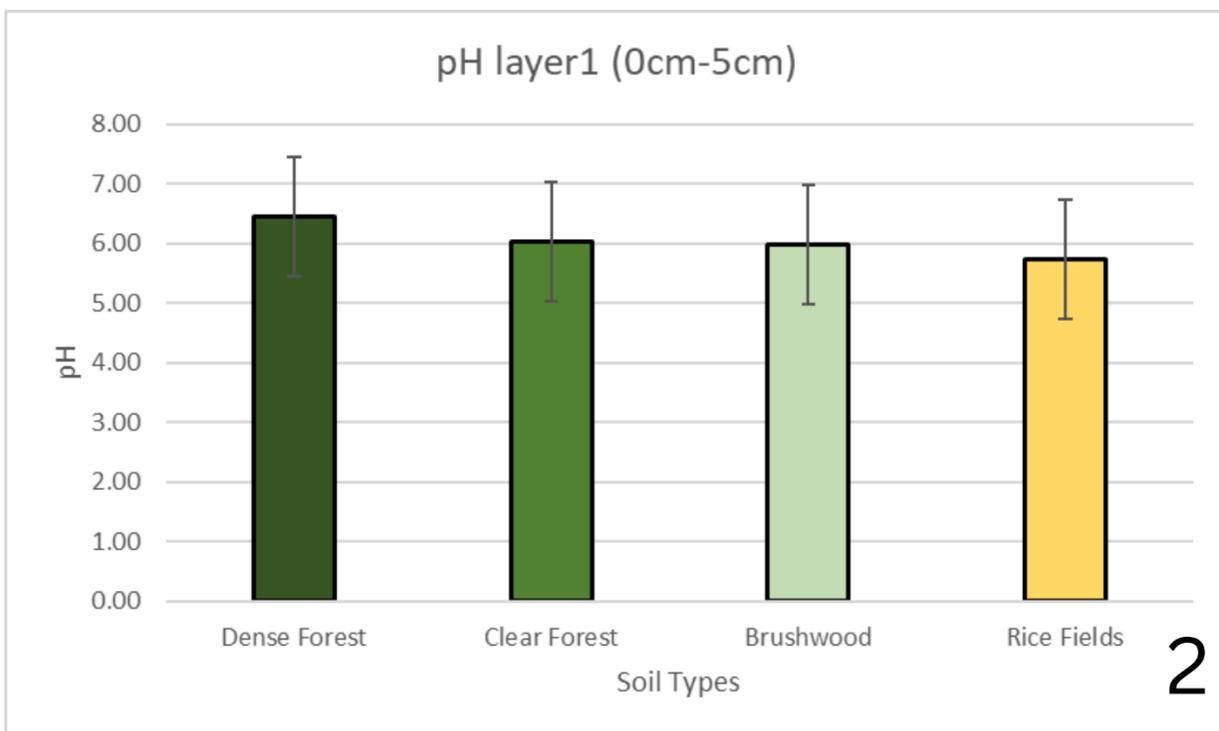
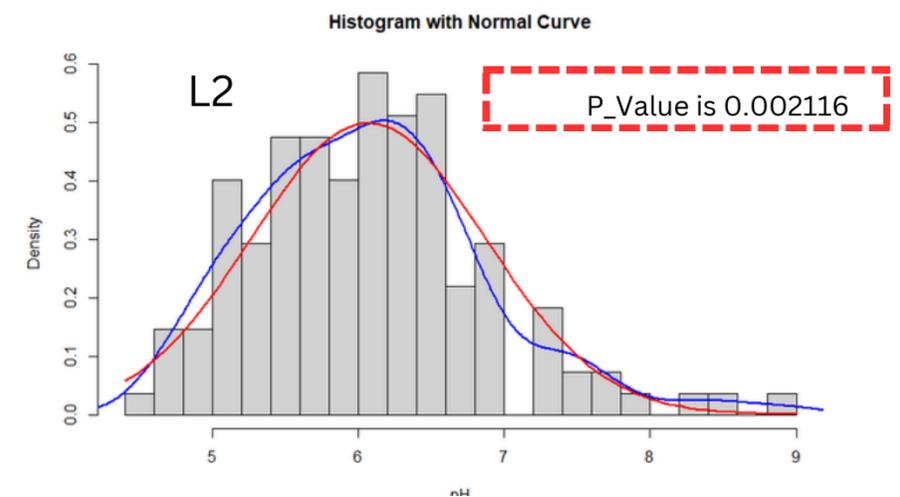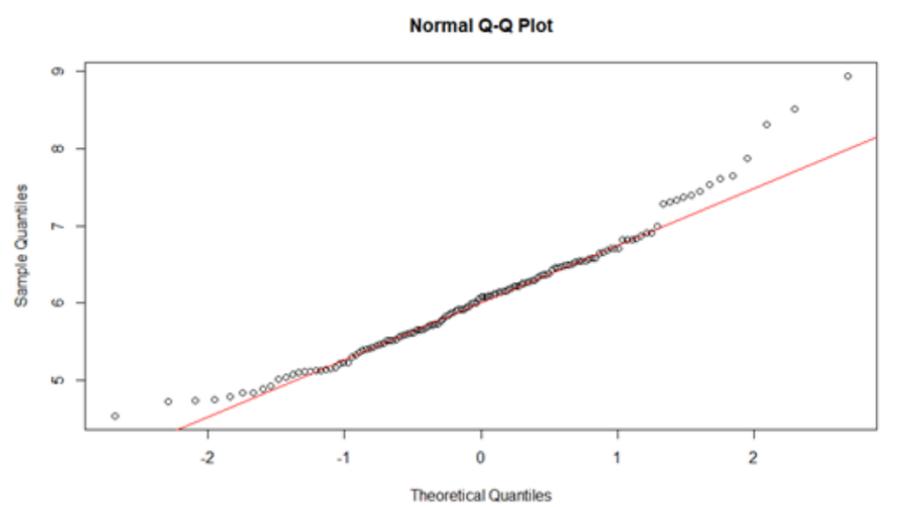The result the pH values ranged first layers from 6.45, 6.03,5.98 and 5.72.
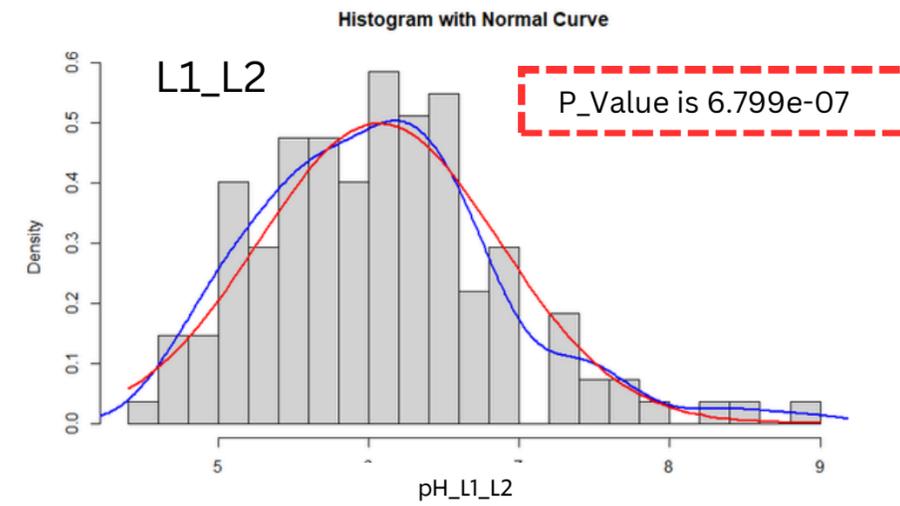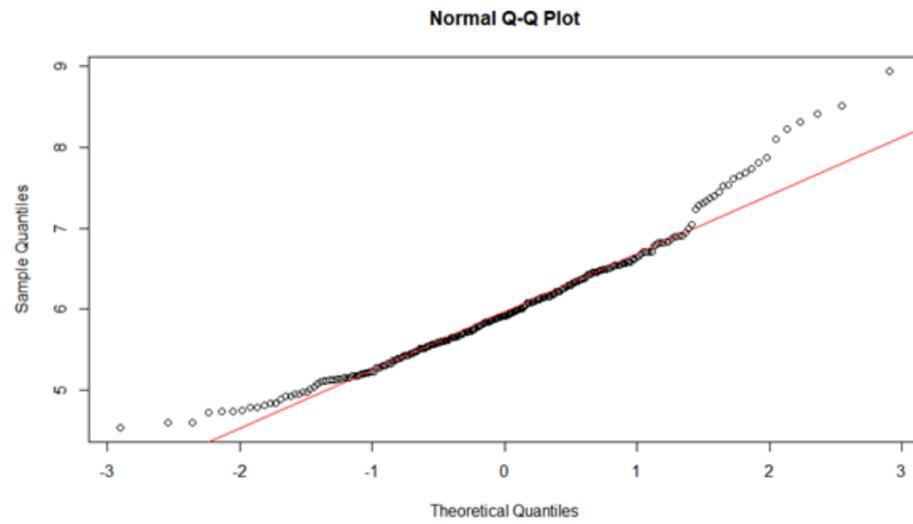
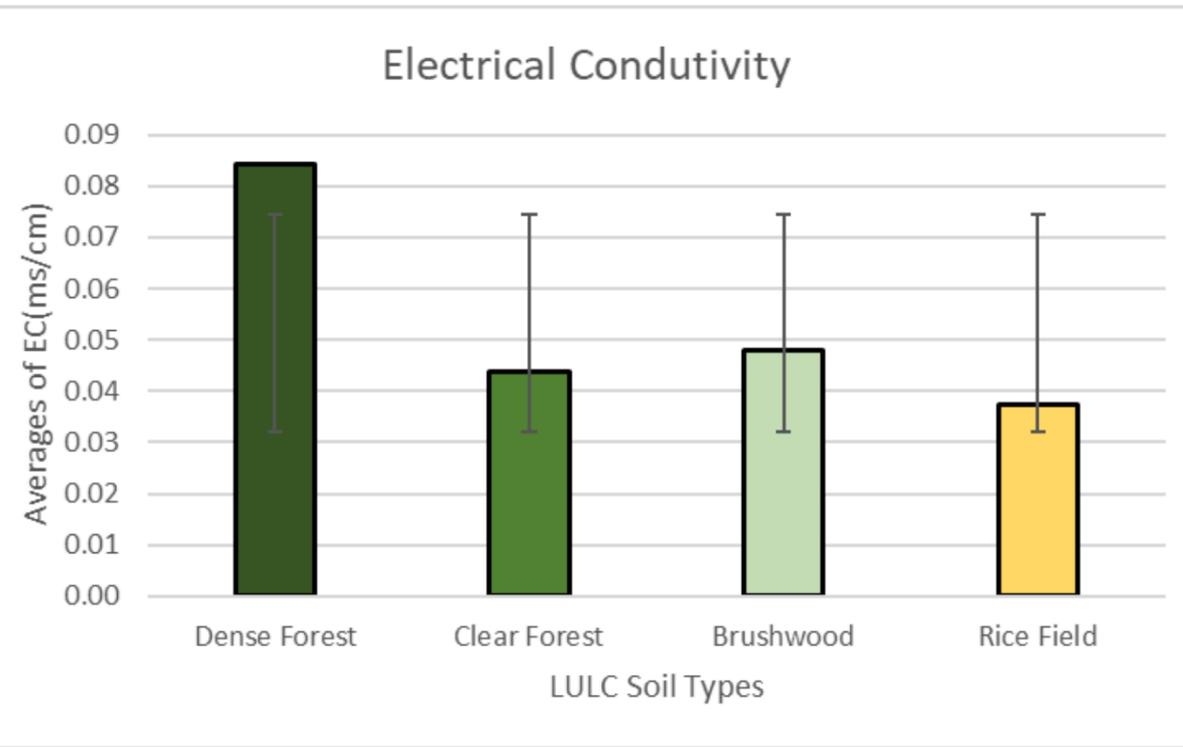The scatter plot show the relationship between pH of different four types of soils.

Since the p-value is less than 0.05, you reject the null hypothesis. This suggests that the data significantly deviates from a normal distribution and it is really visible to the 2 graphs.
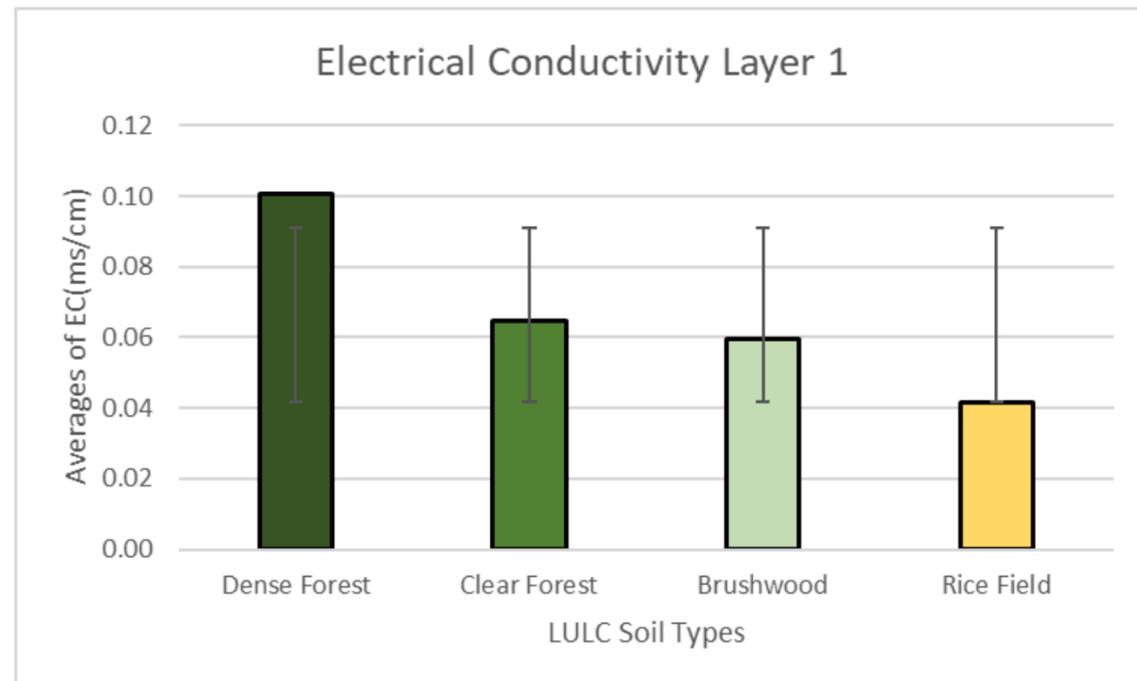
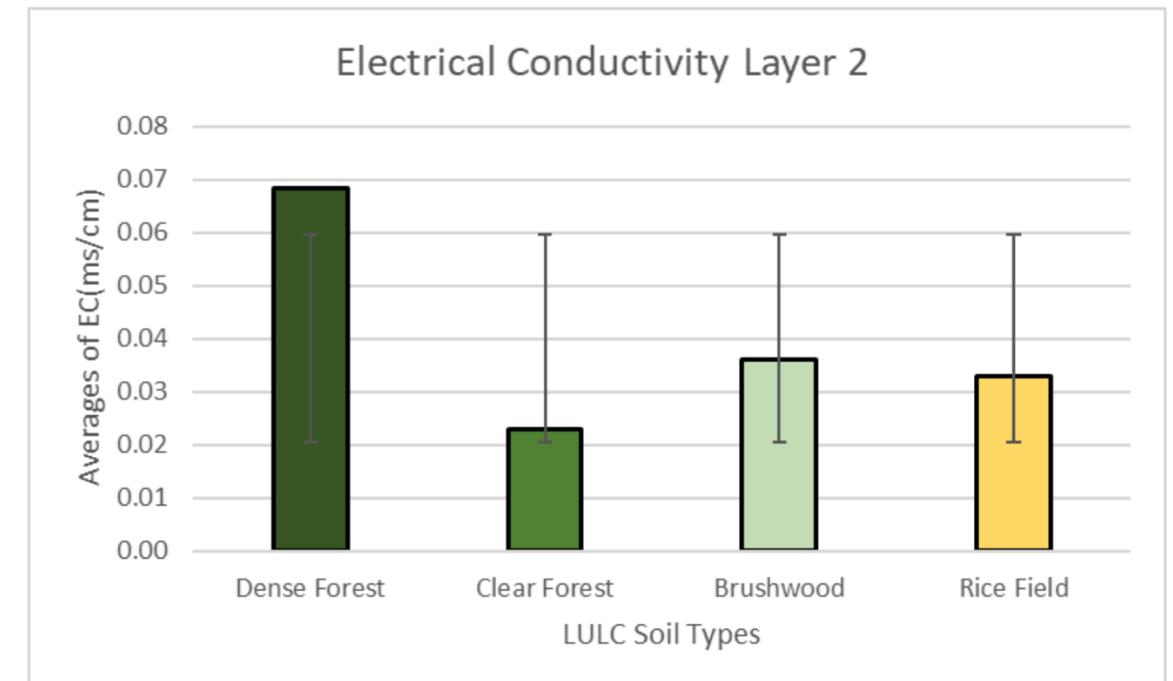# Result and Discussion (Eletrical Conductivity)

The Result of EC values ranged from 0.08mS/cm,0.04mS/cm,0.05mS/cm and 0.04mS/cm. The high Moisture Content, Mineral concentration and organic matter content make dense forest soil generally more electrically conductive compared to the other soil types.
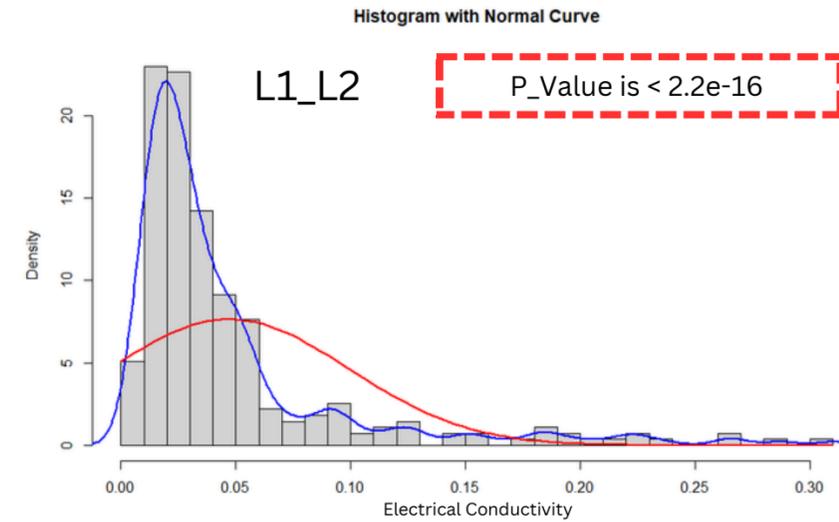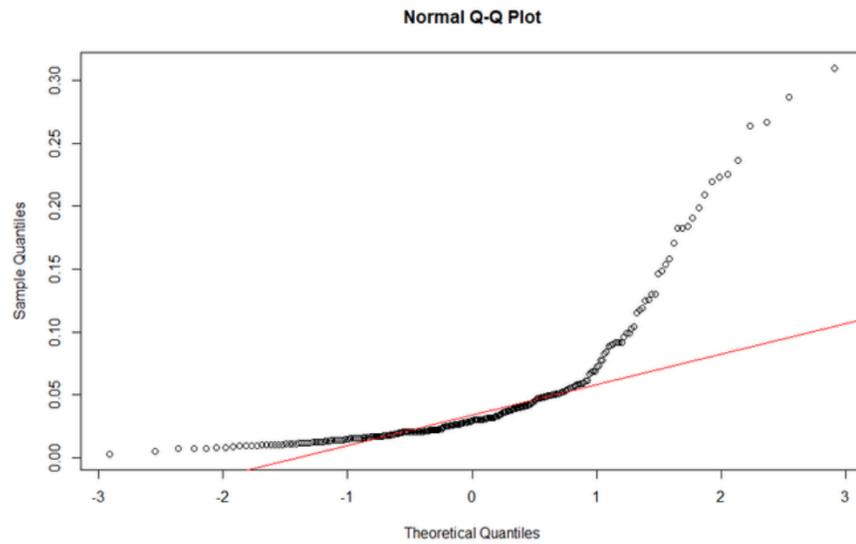
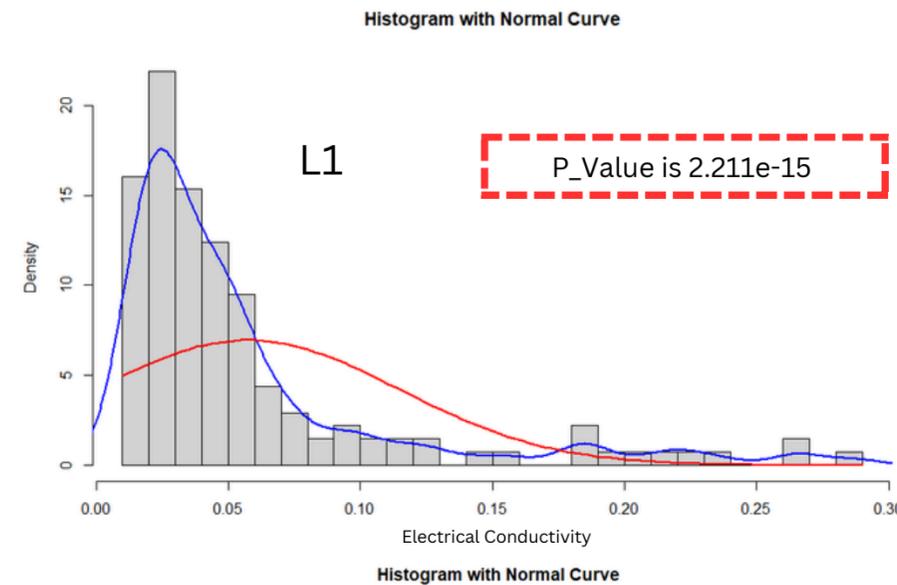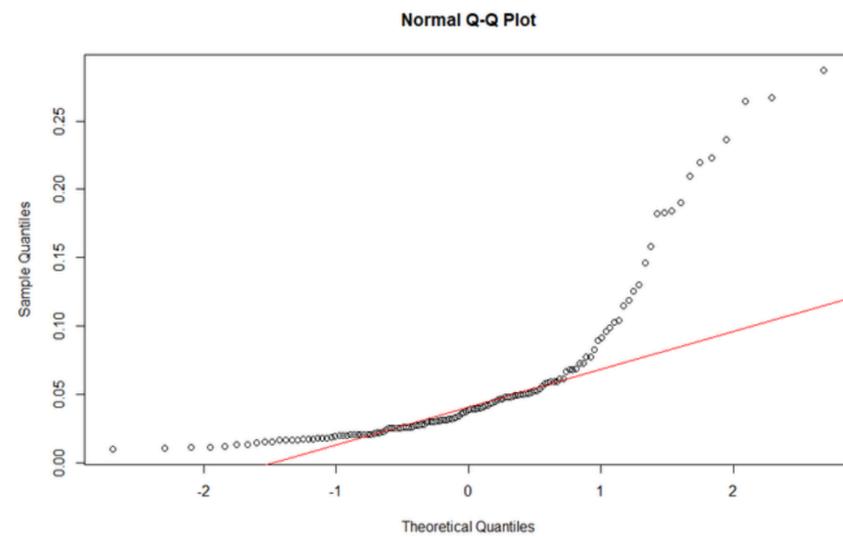The result of study averages is 0.07ms/cm, 0.02mS/cm,0.04mS/cm and 0.03mS/cm.

The result ranged from 0.10mS/cm, 0.06mS/cm,0.04mS/cm.

Normal Q-Q Plot
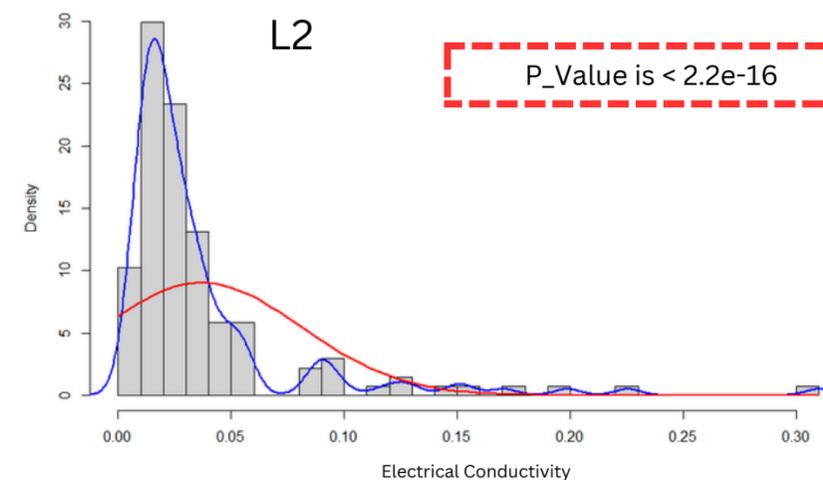
Histogram with Normal Curve

L1_L2

P_Value is < 2.2e-16

The scatter plot show the relationship between Electrical Conductivity of different four types of soils .

Histogram with Normal Curve

L1

P_Value is 2.211e-15

Since the p-value is less than 0.05, you reject the null hypothesis. This suggests that the data significantly deviates from a normal distribution and it is really visible to the 2 graphs.

Histogram with Normal Curve

L2

P_Value is < 2.2e-16

Conclusion

- The result of highest bulk density values is(1.68,1.67,1.66g/cm3) are relatively close to each other, within 0.02g/cm3 from (Clear forest, Brushwood, Rice Field) soils. The lowest bulk density value is 1.28g/cm3 is significantly lower than other three, indicating this material likely has different physical properties. Overall, the range of the bulk density values show variability in the compaction .

- The ranged of pH values across the four land use types of soils falls within the acidic class, which spans from 5.86 to 6.0.

- The Electrical Conductivity ranging from 0.08ms/cm to 0.04ms/cm,, This result indicated that the soil sample have low electrical conductivity, suggesting low levels of soluble salts in the soils.

- In conclusion, The different (bulk density, pH and electrical Conductivity based on the four different types of soils .

Future work

1. Producing bulk Density, pH, EC and particle sizes of soil digital map by using interpolation method in Qgis.

2. The result of Carbon stock from chemical test and the result of near infrared microscopy.

3. Creating the Carbon stock in the soil maps based on carbon result.

4. The comparing of land use land cover map from 1952,1972,1981,2005,2023 and soil geology, topography, distance to the river, steam house hold).