



Geography Field Study Course

Soil Properties



Version 3.0



Objective

1. To measure the soil profiles in different field sites.
2. To examine the properties and characteristics of soil.







Equipment List

Field Work

1 .	2 litre bottle	X	2	<input type="checkbox"/>	<input type="checkbox"/>
2 .	Adhesive labels	X	1	<input type="checkbox"/>	<input type="checkbox"/>
3 .	Beaker	X	1	<input type="checkbox"/>	<input type="checkbox"/>
4 .	Clipboard	X	1	<input type="checkbox"/>	<input type="checkbox"/>
5 .	Cloth	X	2	<input type="checkbox"/>	<input type="checkbox"/>
6 .	Cotton gloves	X	4	<input type="checkbox"/>	<input type="checkbox"/>
7 .	Deionised water	X	1	<input type="checkbox"/>	<input type="checkbox"/>
8 .	Filter funnel	X	1	<input type="checkbox"/>	<input type="checkbox"/>
9 .	Filter paper	X	1	<input type="checkbox"/>	<input type="checkbox"/>
10 .	Forceps	X	1	<input type="checkbox"/>	<input type="checkbox"/>
11 .	Hammer	X	1	<input type="checkbox"/>	<input type="checkbox"/>
12 .	Infiltrometer	X	1	<input type="checkbox"/>	<input type="checkbox"/>
13 .	Measuring tape	X	1	<input type="checkbox"/>	<input type="checkbox"/>
14 .	pH paper	X	1	<input type="checkbox"/>	<input type="checkbox"/>
15 .	pH paper index	X	1	<input type="checkbox"/>	<input type="checkbox"/>
16 .	Plastic bottles	X	2	<input type="checkbox"/>	<input type="checkbox"/>
17 .	Ruler	X	1	<input type="checkbox"/>	<input type="checkbox"/>
18 .	Safety goggles	X	1	<input type="checkbox"/>	<input type="checkbox"/>
19 .	Soil sampler	X	1	<input type="checkbox"/>	<input type="checkbox"/>
20 .	Spatula	X	1	<input type="checkbox"/>	<input type="checkbox"/>
21 .	Test tube	X	1	<input type="checkbox"/>	<input type="checkbox"/>
22 .	Thermometer	X	1	<input type="checkbox"/>	<input type="checkbox"/>
23 .	Timer	X	1	<input type="checkbox"/>	<input type="checkbox"/>
24 .	Trowel	X	1	<input type="checkbox"/>	<input type="checkbox"/>

1 .	Beakers	15 .	High speed stirrer
2 .	Boiling tube	16 .	Hydrometer
3 .	Burner	17 .	Lighter
4 .	Calgon	18 .	Measuring cylinders
5 .	Centrifuge	19 .	Oven
6 .	Conical flask	20 .	Ruler
7 .	Crucible	21 .	Safety goggles
8 .	Crucible tongs	22 .	Sealing film
9 .	Deionised water	23 .	Solution C
10 .	Electronic Balance	24 .	Spatula
11 .	Filter funnel	25 .	Spectrophotometer
12 .	Filter paper	26 .	Test tubes
13 .	Forceps	27 .	Timer
14 .	Glass rod	28 .	Tripod



Field Work

S1. Soil Profile

1. Choose a field site within the field area.
2. Screw the soil sampler into the soil until the bed rock is reached or where you cannot screw it any more.
3. Pull the sampler out with care.
4. Try to distinguish the various horizons in the profile and measure their depth with the ruler provided. Complete Table 3.1.
5. Divide the soil sample into 3 equal parts.
6. Remove the upper part of the soil sample through the cutaway portion of the sampler, put them into plastic bottle 1.
7. Keep the lower part of the soil sample into plastic bottle 2.
8. Divide the middle part of the soil sample into 2 equal parts again.
9. Put them into plastic bottle 3 and 4 respectively.
10. Make sure the cap of each plastic bottle is firmly closed, otherwise the result of lab work may be affected.

S2. Soil Acidity (sub-group)

1. Put one small part of soil sample from plastic bottle 1 (2) into a beaker.
2. Mix the soil sample with two parts of deionised water.
3. Leave the soil sample for one minute to allow the soil and water to approach an equilibrium condition.
4. Filter the soil solution into a test tube.
5. Place a pH paper into the solution.
6. According to the colour change, read the pH value from the provided index and fill it in Table 3.1.

S3. Soil Temperature (sub-group)

1. By inserting the thermometer through the pit into the soil, measure the temperature of the soil at ground surface, 10 cm depth and 20 cm depth at time intervals specified by the instructor.
2. Record the result into Table 3.5.

S4. Soil Infiltration

1. Choose another site nearby.
2. Dig the cylinder of the infiltrometer 5 cm into the soil surface.
3. Fill the cylinder with water until the mark is reached.
4. Invert the full-filled infiltrometer on to the cylinder quickly.
5. Mark the readings of water level immediately.
6. Record the readings in 30-second intervals and fill them in Table 3.4.

S5. Vegetation

1. Refer to Table 3.8.
2. Count the frequency of different vegetation types found around 1 m from the field site.
3. Record them in Table 3.8.



Laboratory Work

S6. Soil Moisture (sub-group)

1. Refer to Table 3.2.
2. First of all, weigh an empty crucible and mark it down.
3. Place the crucible on the balance and put about 50 g soil sample of plastic bottle 1 (2) in it.
4. Then, put the crucible on Plate A. Our Technician will place the sample into the oven where the soil will be dried overnight.
5. In the next day, get back your soil sample from Plate A.
6. ***Pay attention that the crucible may still be hot.***
7. ***Hold the crucible with a cloth and weigh it again.***
8. Mark down the weight of the dried soil with the crucible.
9. Calculate the soil moisture according to the steps in Table 3.2.

S7. Organic Matters (sub-group)

1. Refer to Table 3.3.
2. Use the dried soil sample above.
3. Place the crucible on the tripod.
4. ***DO NOT light up the burner unless the instructor / technician / teacher tell you to do so.***
5. ***Wearing safety goggles is necessary!***
6. ***Burn the soil sample for 20 minutes.***
7. ***Then, use a pair of crucible tongs to take away the crucible and leave it to cool down for a while.***
8. ***Pay attention that the crucible may still be hot.***
9. ***Hold the crucible with a cloth and weigh it again.***
10. Record the weight of the sample with the crucible.
11. Calculate the amount of organic matters according to the steps in Table 3.3.

S8. Soil Texture (Hydrometer Analysis) (sub-group)

1. Refer to Table 3.6.
2. Use the sample above, put them into a 600 ml beaker.
3. Add 10 ml calgon and 100 ml deionised water.
4. Place the beaker on Plate B. The sample will be stirred by a high speed stirrer for 10 minutes.
5. After you get back your sample, wash the soil suspension into a one litre measuring cylinder and dilute the sample to the mark (1 litre) with deionised water.
6. Cap the opening of the cylinder with a sealing film, and then shake it end over end 5 times.
7. Aware that the sample may spill out while shaking.
8. The cylinder is now placed into a water bath of 20 °C, a timer started, and the hydrometer gently inserted so that it is in a position for reading.
9. The first reading is taken after 40 seconds, and this gives the percentage of silt and clay in the soil (U.S.D.A. limits)
10. Allow the cylinder to stand for 2 hours.
11. Take the reading of the hydrometer when time is up. This gives the percentage of clay in the soil sample (U.S.D.A. limits).
12. Record the results in Table 3.6.
13. Calculate the percentages of different components according to the steps in Table 3.7.

S9. Soil Nutrient, Ammonia Content (sub-group)

1. Place the untreated soil sample in plastic bottle 3 (4) into a conical flask.
2. Add two parts of deionised water and shake vigorously for two minutes.
3. Put 10 ml filtered soil water into a test tube and place it on Plate C.
4. Our Technician will separate the water from the suspension by using a centrifuge.
5. After getting back your sample soil water, pour it into a boiling tube carefully.
6. Then add 1 ml of solution C (Nessler's reagent) to the sample.
7. Agitate the mixture for about 20 seconds.
8. A YELLOW colour indicates the presence of ammoniacal nitrogen.
9. Assess the concentration of ammonia by using the spectrophotometer provided.
10. Record it in Table 3.1.



Data Processing

1. Use appropriate diagrams or graphs to represent the findings and their correlation.



Discussion

- Q1. Find out the relationships between the various characteristics of the soil sample.
- Q2. How the environment affect the soil characteristics?
- Q3. State any soil problem found in the site.
- Q4. Suggest remedial measures to the problems stated in Q3.



Data Sheet

Group: _____ Date : _____ Time : _____

Site : _____

Present weather : _____

Has there been rained in the past 3 days? _____

General description of the site : _____

Table 3.1 - Characteristics of Different Soil Horizons

Horizon	Depth	Colour	pH	Ammonia
O	-			
A	-			
B	-			

Table 3.2 - Calculation of Soil Moisture

weight of crucible.....	<input type="text"/>	(1)
weight of crucible + weight of soil sample.....	<input type="text"/>	(2)
weight of soil sample.....	<input type="text"/>	(2) - (1)
weight of crucible + weight of dried soil sample.....	<input type="text"/>	(3)
weight of dried soil sample.....	<input type="text"/>	(3) - (1)
amount of soil moisture.....	<input type="text"/>	(2) - (3)
% of soil moisture.....	<input type="text"/>	(4)

Table 3.3 - Calculation of Organic Matters

weight of crucible + weight of dried soil sample.....	<input type="text"/>	(3)
weight of crucible + weight of burnt soil sample.....	<input type="text"/>	(5)
weight of burnt soil sample.....	<input type="text"/>	(5) - (1)
weight of organic matters.....	<input type="text"/>	(3) - (5)
% of organic matters.....	<input type="text"/>	(6)

Table 3.4 - Estimation of Soil Infiltration

Time	Reading
0.5 min	
1.0 min	
1.5 mins	
2.0 mins	
2.5 mins	
3.0 mins	
3.5 mins	
4.0 mins	
4.5 mins	
5.0 mins	
5.5 mins	
6.0 mins	
6.5 mins	
7.0 mins	
7.5 mins	

Time	Reading
8.0 mins	
8.5 mins	
9.0 mins	
9.5 mins	
10.0 mins	
10.5 mins	
11.0 mins	
11.5 mins	
12.0 mins	
12.5 mins	
12.0 mins	
13.5 mins	
14.0 mins	
14.5 mins	
15.0 mins	

Table 3.5 - Soil Temperature of Different Depth

Time	Ground Surface	10 cm Depth	20 cm Depth
5 mins			
10 mins			
15 mins			
20 mins			
25 mins			
30 mins			
35 mins			
40 mins			
45 mins			
50 mins			
55 mins			
60 mins			

Table 3.6 - Estimation of Soil Texture

Component	Elapsed Time	Weight (g/l)
Silt & Clay	40 seconds	(7)
Clay	2 hours	(8)

Table 3.7 - Calculation of Soil Texture

weight of soil sample.....	<input type="text"/>	(5) - (1)
weight of sand.....	<input type="text"/>	(5) - (1) - (7)
% of sand.....	<input type="text"/>	(9)
weight of silt.....	<input type="text"/>	(7) - (8)
% of silt.....	<input type="text"/>	(10)
weight of clay.....	<input type="text"/>	(8)
% of clay.....	<input type="text"/>	(11)

According to the Soil Texture Triangular Graph provided, the soil sample should be classified as _____.

Table 3.8 - Frequency of Different Vegetation Types

Vegetation Type	Frequency
Tree	
Shrub / Sapling	
Herb / Grass / Fern*	

* count 0.5 m as a cluster

