Exploring Woodland in Cheung Chau (1.5 days)

Name： _____

Group no.： _____

Course Date： _____

Relevance to the DSE geography curriculum：

Disappearing Green Canopy – Who should pay for the massive deforestation in rainforest regions?

Knowledge:
- To understand the characteristics of abiotic and biotic components of a woodland ecosystem
- To understand the structure of woodland and the characteristics of woody plants in woodland

Skills:
- To collect data of vegetation and soil
- To compare and analyze primary data

Attitude:
- To cherish the interdependence of human and natural environment
- To nurture students'concern of the tropical rainforest and awareness of the importance of protection of tropical rainforest on safeguarding national ecological security

Prior knowledge

What is the nutrient cycling and water cycle of woodland?

Refer to the module of "Disappearing Green Canopy" in the textbook and study Figure 1a. Choose the letters from dotted boxes and put in circles below.

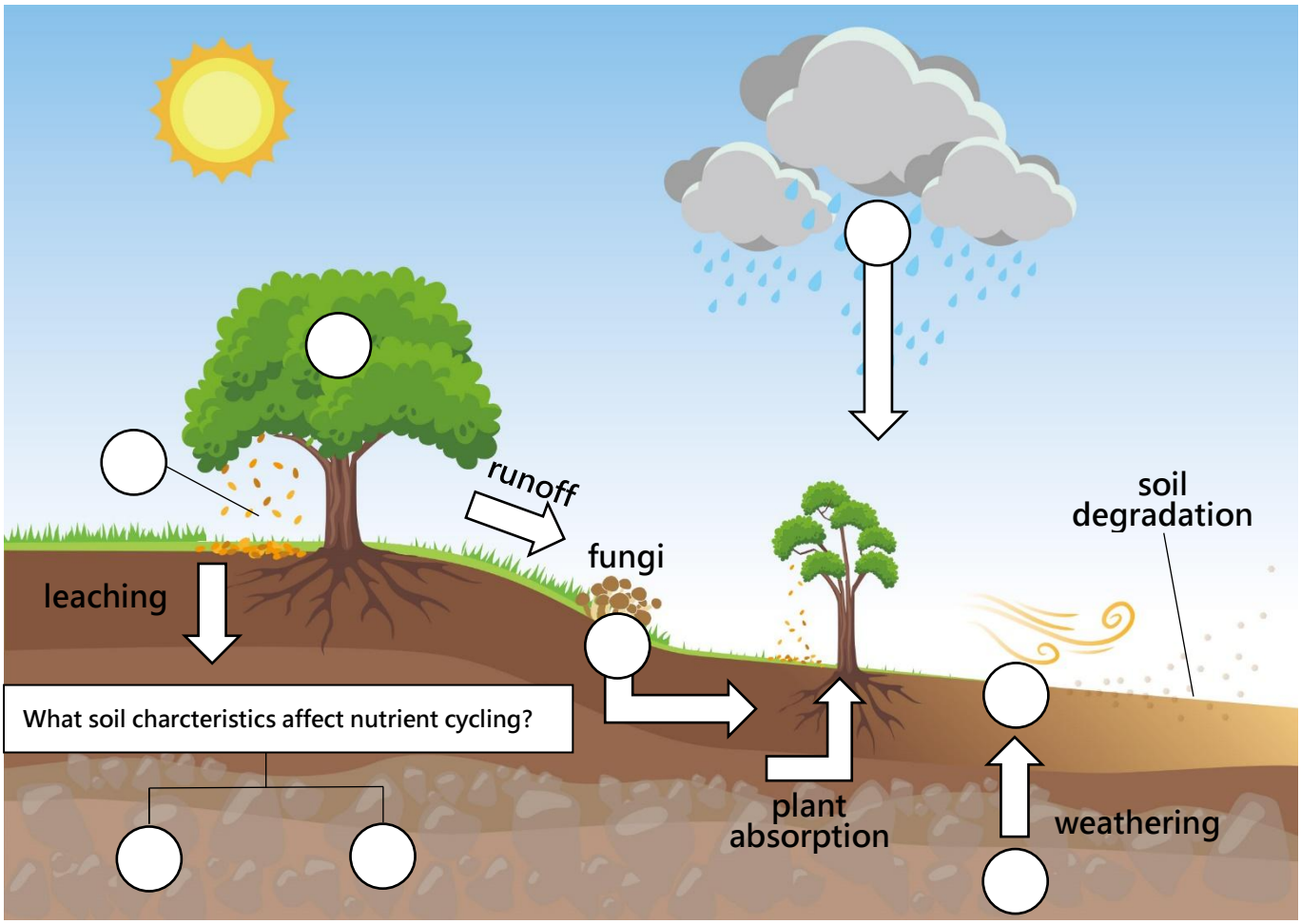


Figure 1a Nutrient cycle in a woodland

A. Biomass **B. Soil** **C. Litter** **D. Soil drainage**

E. Rainfall **F. Decomposition** **G. Soil texture** **H. Parent rock**

Refer to the module of "Disappearing Green Canopy" in the textbook and study Figure 1b. Choose the letters from dotted boxes and put in circles below.

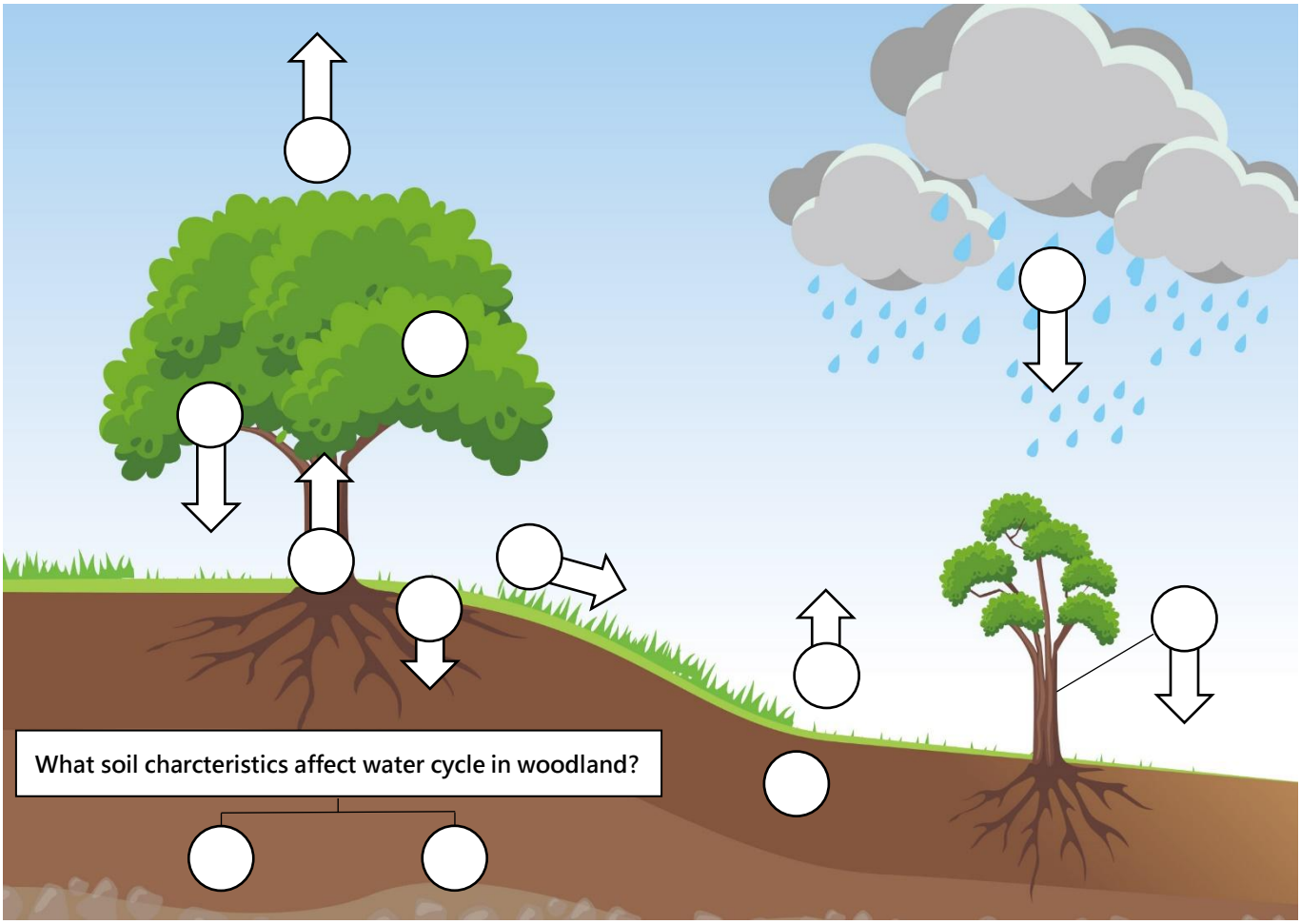


Figure 1b Water cycle in a woodland

A. Precipitation B. Transpiration C. Plant absorption D. Surface runoff

E. Interception F. Stemflow G. Evaporation H. Infiltraion

I. Throughfall J. Soil storage K. Soil texture L. Soil structure

Stage 1：Planning and preparation

➢ **Key point of fieldwork:** Linkages of abiotic and biotic components of woodland ecosystem, the structure of woodland and the characteristics of woody plants in woodland.

To set the enquiry question

1. Relationship between vegetation and soil in a woodland ecosystem.
   Hypothesis:
   a) The higher the canopy density, the lower / higher the soil fertility.
   b) The higher the canopy density, the lower / higher the soil moisture.
   c) The higher the light intensity, the lower / higher the undergrowth cover.

2. Compare the structure and the characteristics of woodland and the tropical rainforest.

When to collect data?

Date: _____	Time: _____ to _____	What factors do you consider when selecting fieldwork date?
Cloud cover: clear sky / few clouds / scattered clouds / overcast sky		
Weather warning and signals within last 3 days: ☐ Strong Monsoon Signal ☐ Rainstorm Warnings ☐ Tropical Cyclone Warning Signals ☐ Thunderstorm warning ☐ Very Hot Weather Warning ☐ Other:_____ Precipitation within last 3 days: heavy rain / drizzle / never rain		Is today an ideal day for conducting woodland field trip? Why?

Where to collect data?

Field site of today: _____ Refer to the map on p.21, is it an ideal place to visit? What factors do you consider when selecting field sites?	Which sampling method is used if students set up data collection locations as follows? (Refer to the sampling method on p.20) 1. The position closest to the woodland entrance was taken as the data collection. ☐ 2. A sampling plot was set every 4 m along the transect, and each group collected data in a different sampling plot. ☐ 3. In the sampling area, select one of the most representative locations as the sampling point. ☐

What data to collect?

Refer to the information on p.6, match the following research items with the appropriate primary data collection method and the equipment.

Primary data collection methods (details on p.19):

A.	**Observation**	**B.**	**Measurement**	**C.**	**Counting**	**D.**	**Category**		
E.	**Distribution (mapping)**	**F.**	**Scoring**	**G.**	**Field sketching**	**H.**	**Questionnaire**	**I.**	**In-depth Interview**

		Research items	Primary data collection methods (You may choose more than one options)	Equipment (refer to p.6)	Operational precautions
Vegetation	Tree	Tree height			
		Crown width			
		Circumference of tree trunk			
		Canopy density			
	Shrub	Shrub height			
	Undergrowth	Undergrowth cover			
		Other characteristics of woody plants: root/ leaves/ climbers			
		Vertical stratification			
Soil		Soil moisture			
		Soil fertility			
		Soil texture			
Environment		Light intensity			

When choosing an equipment/tool for data collection, you would consider…

To learn more...

Equipment and materials

Item	Photo	Quantity (each group)	Item	Photo	Quantity (each group)
1. measuring tape (50m)		1 (share)	8. soil moisture meter		1 (share)
2. measuring tape (30m)		1	9. soil NPK meter		1 (share)
3. grid quadrat		1	10. deionized water		1
4. rope (4m)		2	11. trowel and soil sample bottle		1
5. Abney level		1	12. gloves		1
6. light meter		1	13.field identification guide for woody plants		1
7. densiometer		1	14. canopy density rating table (observation)		1

** Make sure you know how to use the equipment correctly before fieldwork.*

Stage 2： Data collection

Group no:_____ **Transect section *(circle where appropriate)***

0-4m／4-8 m／8-12 m／12-16 m／16-20 m／20-24 m／24-28 m／28-32 m /32-36 m /36-40 m /40-44 m /44-48 m

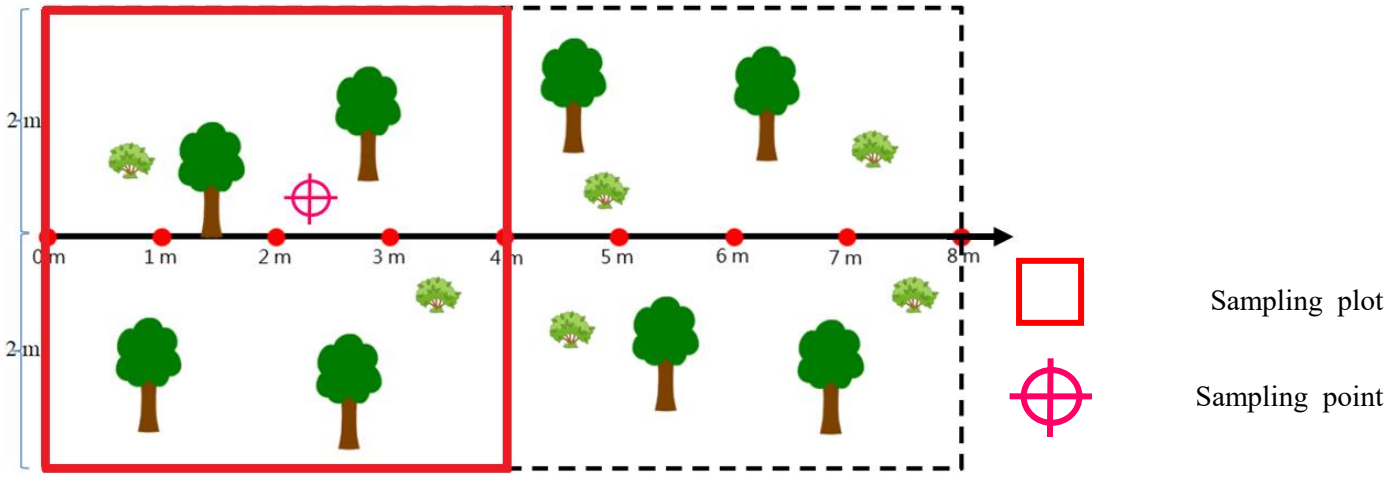


Figure 2 Sampling plot and sampling point

Part 1：Tasks of sampling plot	**Part 2：Tasks of sampling point**
Within the sample plot, carry out the following tasks: 1. Select **ONE representative tree**: a) measure tree height b) measure crown width c) measure circumference of tree trunk 2. Select **ONE representative shrub** and measure its height. 3. Observe and identify the characteristics of woody plants.	Select a sampling point of **the most representative canopy density**, carry out the following tasks: 1. Measure light intensity 2. Collect canopy density data: (①take photo of canopy (Counting) ; ② observation and category) 3. Count undergrowth cover 4. Measure soil moisture 5. Collect ONE soil sample (bottlefull)

Experiment: Soil Fertility, Soil Moisture, and Soil Texture

A. Pre-Experiment Sample Preparation

Mix soil samples from areas with similar canopy density to obtain samples from areas with higher and lower canopy density. Each group collects one bottle of soil sample.

(According to teacher's instructions, please tick the area you are responsible for and circle the appropriate group.)

☐ High canopy density area (group：1 / 2 / 3 / 4 / 5 / 6 / 7 / 8)
☐ Low canopy density area (group：1 / 2 / 3 / 4 / 5 / 6 / 7 / 8)

What sampling method is applied when collecting soil samples based on the level of canopy density?

B1. Soil Fertility [Soil NPK Test Kit]

Follow teacher's instructions to use the soil NPK test kit to determine soil fertility levels. Record the results in the table below.

Group	**Responsible Element***	**Score***		
		0 pts	1 pt	2 pts
My Group	Nitrogen (N) / Phosphorus (P) / Potassium (K)	Low	Medium	High
Other Group	Nitrogen (N) / Phosphorus (P) / Potassium (K)	Low	Medium	High
Other Group	Nitrogen (N) / Phosphorus (P) / Potassium (K)	Low	Medium	High

Total Score = _____ (Sum of scores for N, P, K)	0 – 1 pts	2 – 3 pts	4– 6 pts
Total soil fertility level *	**Low**	**Medium**	**High**

* Circle your choice

Based on the soil NPK test kit results:

Total soil fertility level in **high canopy density area**: Low / Medium / High
Total soil fertility level in **low canopy density area**: Low / Medium / High

B2. Soil Fertility [Soil NPK Meter]

1. Add deionized water to the soil sample until the water level is above the soil (fully saturated).
2. Insert the metal tip (sensor) of the soil NPK meter into the soil sample and read the displayed values.
3. Measure the concentration of Nitrogen (N), Phosphorus (P), and Potassium (K) separately and record in the table.

Soil Fertility	High canopy density area	Low canopy density area
Available Nitrogen (N)	ppm	ppm
Available Phosphorus (P)	ppm	ppm
Available Potassium (K)	ppm	ppm
Total	**ppm**	**ppm**

Total soil fertility level based on NPK meter:
High canopy density area: _____ ppm
Low canopy density area: _____ ppm

B3. Consolidation

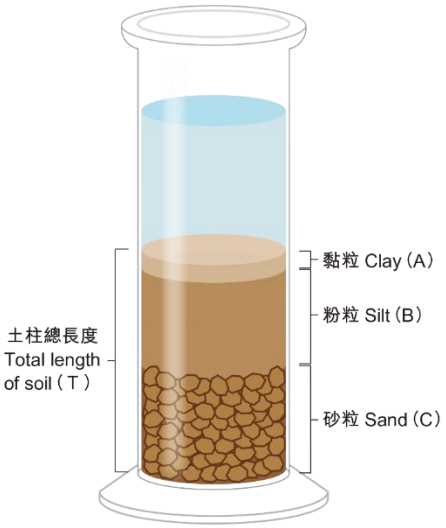
Compare results from the NPK test kit and the NPK meter.

Soil fertility test method	High canopy density area	Low canopy density area
1. NPK Test Kit	Low / Medium / High	Low / Medium / High
2. NPK Meter	ppm	ppm

C1. Soil texture [Labwork - Sedimentation]

Remove larger particles from the soil sample and use sedimentation to determine soil texture.

Experimental item		High canopy density area	Low canopy density area
Total length of soil column (cm)	〔T〕		
Length of clay column (cm)	〔A〕		
Length of silt column (cm)	〔B〕		
Length of sand column (cm)	〔C〕		
Percentage of clay (%)	〔(A / T) x 100 %〕		
Percentage of silt (%)	〔(B / T) x 100 %〕		
Percentage of sand (%)	〔(C / T) x 100 %〕		
Soil texture class (find from the graph below)			



Result of soil sedimentation

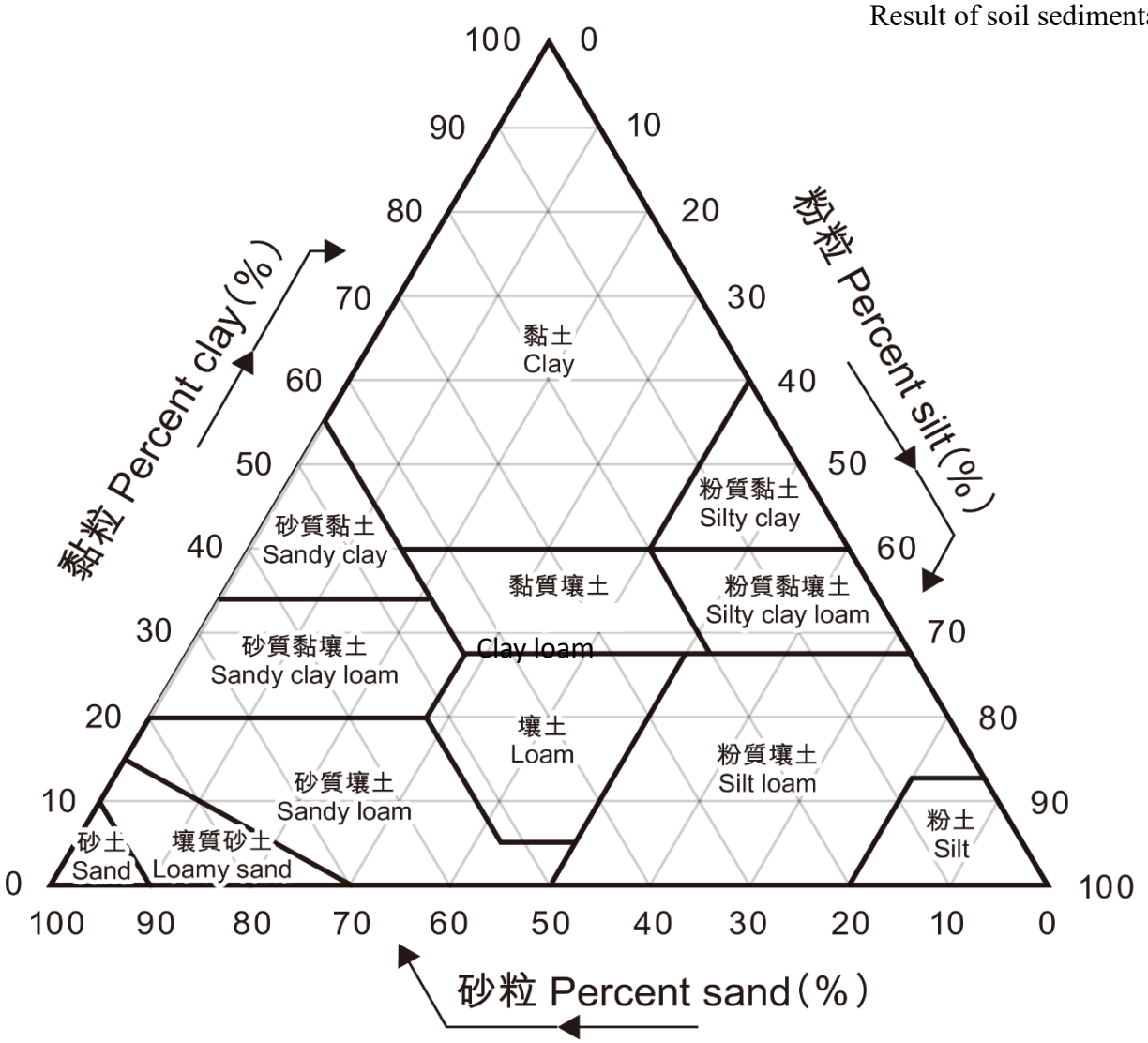


Figure 3 Soil texture triangular graph

C2. Soil Texture [Feel Test]

Follow the steps in the diagram to determine soil texture.

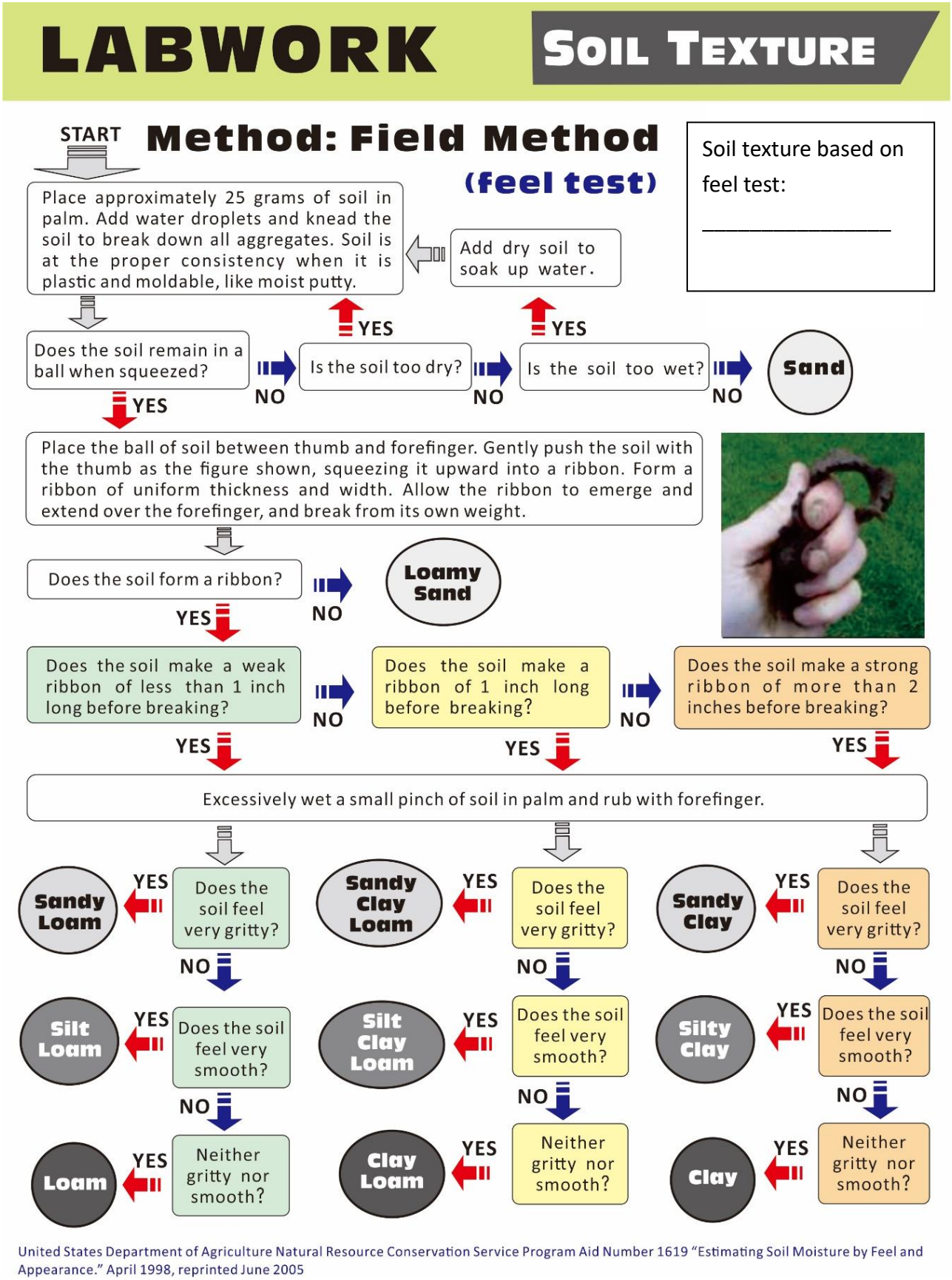


Figure: Steps of feel test

C3. Consolidation

Compare results from sedimentation and feel test.

Soil texture test method	High canopy density area	Low canopy density area
1. Sedimentation		
2. Feel test		

D1. Soil water content [Experiment]

Use gravimetric method to determine soil moisture content.

Steps:

1. Remove larger particles from the soil sample.
2. Use electronic balance to measure the weight of the evaporating dish and record it.
3. Place 20g of wet soil into the dish.
4. Measure and record the total weight of wet soil and dish **(M1)**.
5. Label the dish and place it in an oven at 105°C for at least 2 hours.
6. After cooling, measure and record the total weight of dry soil and dish **(M2)**.
7. Use the formula below to calculate soil moisture percentage.

$$\text{Soil water content (\%)} = \frac{M1 - M2}{M1} \times 100\%$$

	High canopy density area	Low canopy density area
Dish weight (g)		
Dish weight (g)+ Wet Soil Weight (g) **(M1)**		
Dish weight (g) + Dry Soil Weight (g) **(M2)**		
Soil water content (%)	%	%

D2. Soil Moisture [Instrument]

Use a soil moisture meter to measure soil moisture.

Steps: 1. Add deionized water to the soil sample until fully saturated.

2. Insert the metal tip (sensor) of the moisture meter into the soil sample and record the displayed value.

	High canopy density area	Low canopy density area
Soil Moisture (%)		

D3. Consolidation

Compare results from gravimetric method and moisture meter.

Soil Moisture Test Method	High canopy density area	Low canopy density area
1. Gravimetric Method (%)		
2. Moisture Meter (%)		

Stage 3：Data processing and presentation

1. Collect and integrate the data of each group and fill in the table below.

Level of Canopy Density		Higher canopy density					Lower Canopy Density				
Group						Average					Average
Location of sample point (m)						N.A					N.A
Canopy Density	25-grid densiometer (%)										
	100-grid densiometer (%)										
	Observation (Level)										
Light Intensity (Lux)											
Undergrowth cover (%)											
Soil moisture (%)											
Soil water content (%)											

Soil Fertility	Total Fertility Level [NPK Test Kit] (Low / medium / High)										
	Total Fertility Level (ppm) [NPK Meter]										
Soil Texture	Sedimentation										
	Feel Test										

2. What diagram can show the following situations? Write the name of diagram below.

Situations	Name of diagram
a) To show the variation of soil moisture along the transect	
b) To compare the light intensity of different sampling points	
c) To compare soil fertility of different canopy density levels	

3. Integrate the vegetation data (p.23-24), compare the structure and woody plant characteristics of the studied woodland and tropical rainforest.

		Studied woodland (Hong Kong)	Tropical rainforest
Tree (incl. emergent, canopy & understorey)	Tree height		Emergent layer: 50m or above Canopy layer : 20-35 m Understorey layer: 10-20 m
	Crown width		13-22 m
	Circumference of tree trunk		140 cm
	Canopy density		40-80% (up to 95%)
Shrub layer	Shrub height		Less than 5 m
Undergrowth	Undergrowth cover		Sparse vegetation; low
Vertical stratification (observation)			5 layers

Stage 4：Interpretation and conclusion

Are your hypothesis valid? Explain with reference to the data collected. Explain whether there are other factors which might support your conclusion.

1. Hypothesis: The higher the canopy density, the lower / higher the soil fertility.	Hint: I expect "The higher the canopy density, the lower / higher the soil fertility." The result is consistent / inconsistent with my hypothesis. Which location has the highest soil fertility? Why? Factors: nutrient cycling (Fig 1a)/ time/ weather/ feature of sampling plot/ sampling location/ human factor. What field evidence are there? What is/are the dominant factors affecting soil fertility?
2. Hypothesis: The higher the canopy density, the lower / higher the soil moisture.	Hint: I expect "The higher the canopy density, the lower / higher the soil moisture." The result is consistent / inconsistent with my hypothesis. Which location has the highest soil moisture? Why? Factors: water cycle (Fig 1b)/ time/ weather/ feature of sampling plot/ sampling location/ human factor. What field evidence are there? What is/are the dominant factors affecting soil moisture?
3. Hypothesis: The higher the light intensity, the lower / higher the undergrowth cover.	Hint: I expect "The higher the light intensity, the lower / higher the undergrowth cover." The result is consistent / inconsistent with my hypothesis. Do the undergrowth cover similar in your sampling plot? Factors: time/ weather/ feature of sampling plot/ sampling location/ human factor. What field evidence are there? What is/are the dominant factors affecting undergrowth cover?

4. Refer to the data collected (p.13-14), how similar are the studied woodland and TRF? Why?

	Hint: Relevant to climate and environment? Do the woodland structure and characteristics of woody plant reflect their similarities?

Stage 5: Evaluation

Factors affecting the data reliability and validity		Suggestion for improvement
Fieldwork date/ time ◆ Fieldwork date and time representative? ◆ Any impact by today's weather condition?		
Field site/ study area ◆ Field sites match with research topic? ◆ Field study area adequate?		
Location of data collection (Sampling) ◆ Sampling method in choosing field site appropriate? ◆ Location of measurement representative? ◆ Sample size sufficient?		
Data collection items/ methods ◆ Data collection items adequate to respond the enquiry questions? ◆ Are the data obtained from the data collection method(s) objective and without bias? ◆ Any inadequacy about the equipment/ instruments? ◆ Measurer using the equipment/ instruments correctly?		

My Field Trip Diary

- Related modules: Disappearing Green Canopy
- Key point of fieldwork/topic: To study the relationships between vegetation and soil in a woodland ecosystem/ To investigate the structure and the characteristics of plants of a woodland.

▪ Date:_____ (Weekday/ Public holiday) ▪ Time:_____ ▪ Field site: _____	▪ Weather condition:
Is the above planning appropriate for the fieldwork?	

- Primary data:

Data collection method	Data collected	Equipment/ Material (if any)	Merit☺/ Limitation☹ of the data collection method (give examples)	Suggestion for improvement (give explanations)

- Secondary data:

Data collected	Use	Data obtained from
Apart from the above, what other secondary data could be used for further investigation?		

- Sampling method (if any):

Sampling method	Applied in the following	Merits☺/ Demerits☹

- Data processing and presentation:

Type of graph/ chart	Content shown and function of graph/chart	Merits☺/ Demerits☹

- For deeper learning or further study, I suggest modify the following aspects.

		Suggestion (give examples)
❑	Key point of fieldwork/ topic	
❑	Data to be collected and method of data collection	
❑	Date and time of fieldwork	
❑	Field site	

Primary data collection methods

Data collection methods	Explanations		Examples
A) Observation	● Using sensory observation to explore the details of research subject (people, things or environment) in a purposive and planned way. Data are recorded using text, photos, sketch, map, etc. (Refer to other data collection methods listed below)		● Identification of the surrounding environment of a field site
B) Measurement	● To estimate or measure the physical quantity of the research subject. It usually requires the use of equipment or tools. Data are usually shown in certain standard, weights or measures.		● Measurement of the width of street and the building height
C) Counting	● To record the number of occurrence of a single item.		● Statistics of pedestrian flow at the pier
D) Category	● To classify based on the nature, characteristics and uses: ♦ to group the same or similar things; ♦ to separate different things.		● Types of goods sold in supermarket ● Customers (serving local residents and tourists) of different shops
E) Distribution (mapping)	● To group similar things according to the research topic (similar to "**D. Category"**); ● Only suitable for spatial representation (different from category); ● Useful in showing the mode of occurrence of research subject in a complex environment.		● Distribution of shops selling big fish balls in Cheung Chau
F) Scoring	● To quantify abstract or subjective concepts; ● To merge various data for easy comparison; ● Scoring items should include different aspects.		● Risk index of natural hazards of Cheung Chau ● Air Quality Health Index (AQHI)
G) Field sketching	● To make simplified drawing of the field site to show what the data collectors observed. Annotations related to the research subject are added to provide key feature or additional information.		● Draw the characteristics and formation of weathering landforms
H) Questionnaire	● Forms: face-to-face, telephone, written, etc.; ● Using questionnaire to understand the opinion of research subject; ● Larger sample size than "**I. in-depth interview"**; ● Mainly closed questions (with options available).	● To collect information by questioning; ● To obtain information which is difficult to be obtained through observations; ● To understand the rationales and opinions of interviewees.	● The main reasons for tourists to visit Cheung Chau ● The level of satisfaction among residents regarding a revitalization project
I) In-depth Interview	● To obtain information through face-to-face/ telephone interview; ● Smaller sample size than "**H.Questionnaire"**; ● Mainly open questions and forthcoming questions will change upon the answer of respondents.		● Opinions of District Council members on the future development of that district

Sampling Methods

Probabilistic sampling methods

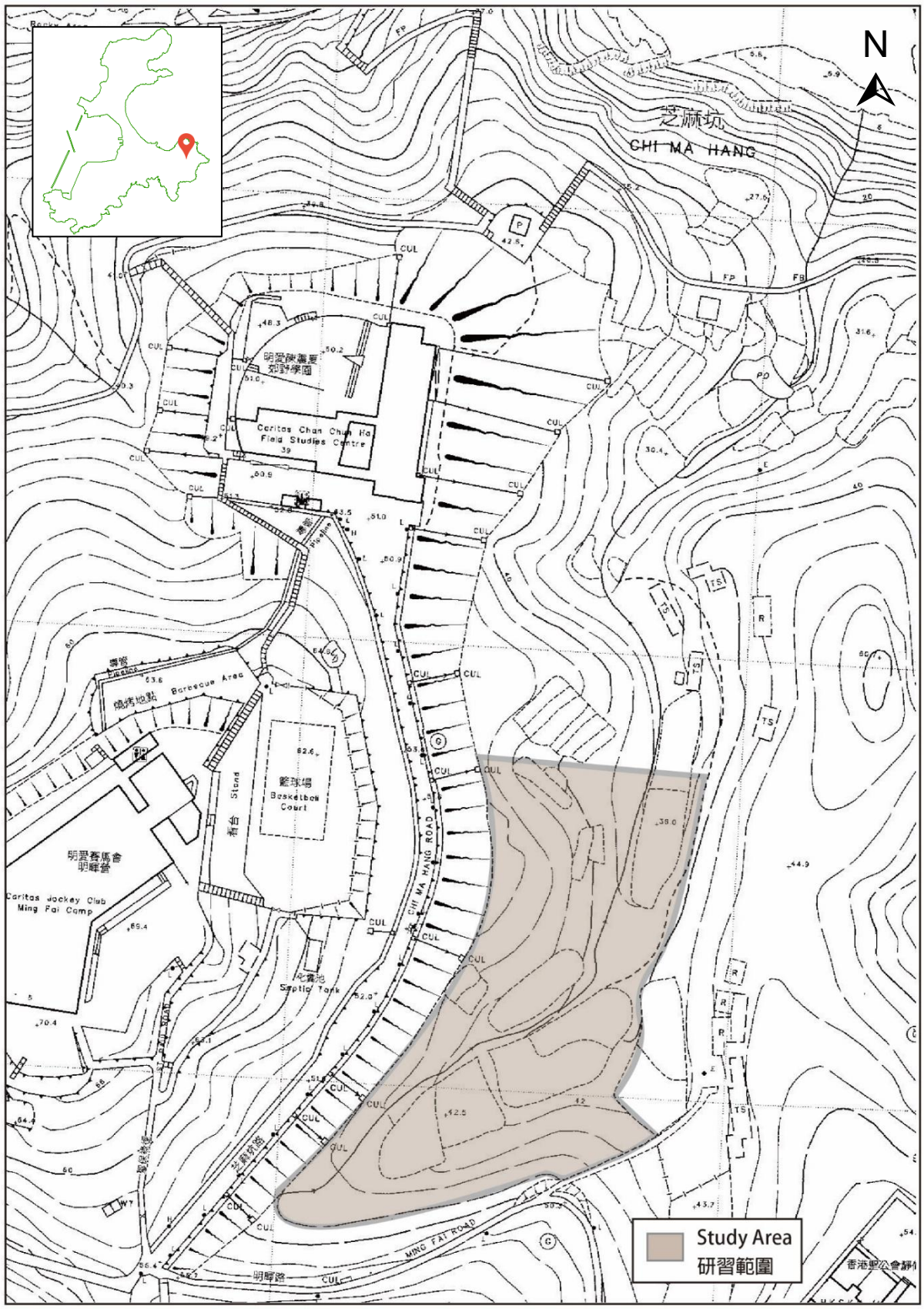
- *Need to know the size of population;*
- *Few differences among individuals;*
- *Individual has equal chance of being selected;*
- *Representativeness of data depends on sampling percentage.*

Non-probabilistic sampling methods

- *Size of population might not be relevant to the research objective;*
- *Chance of individual being selected is unknown;*
- *Representativeness of the results depends on the judgment of researcher in sample selection (Such as the correlation between samples and research targets).*

Sampling methods	Simple random sampling (簡單隨機抽樣)	Systematic sampling (系統抽樣)	Stratified sampling (分層抽樣)	Quota sampling (配額抽樣/ 定額抽樣)	Convenience sampling (便利抽樣/ 方便抽樣)	Purposive sampling (立意抽樣)
Explanations	To select sample from the **whole population randomly**. (using computer program, bamboo slip or random number table)	Each member of the whole population is sequentially numbered, then selected according to a **fixed, periodic interval**.	The whole population are classified according to the variable and divided into separate stratum. Then samples are selected randomly by proportion from each stratum.	The whole population are classified according to the variable and divided into separate stratum. Then desired number (quota) of samples are selected from each stratum.	Research subjects are selected due to convenience of recruitment.	Samples are selected according to research objectives and special requirements.
Examples	To choose a certain number of students to conduct questionnaires/ surveys according to the class number.	To measure the noise level of a street in a regular interval.	To group buildings according to their ages (e.g. above or below 50), and select a certain number of buildings in each group randomly.	To select a certain number of male and female customers, then record the amount spent in a shop.	To interview a certain number of relatives who work in mainland China To interview a certain number of passersby on the street	To conduct an in-depth interview with a district councilor about the social problems of that district.
Remarks	Suitable for small population and few variations among samples (for relevant research objectives).	Suitable for large population (hidden cyclic ordering which may affect the representativeness of data).	Effectively show the relationship / effect between variables.	Effectively show the relationship / effect of variables, but the characteristics and size of samples are judged subjectively.	Should not generalize the data to larger population	Suitable for qualitative research (data is easily influenced by the subjective judgment of researcher)

Fieldsite of woodland in Cheung Chau



Group no. _____

Exploring Woodland in Cheung Chau

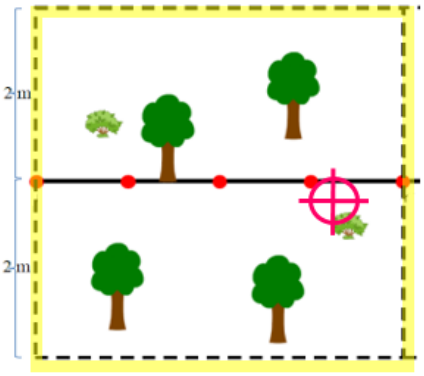
Data record sheet

Date:_____ Time:_____ Weather: sunny/ cloudy / rainy / windy

Transect section:_____m to_____m

Environmental features：_____

Tasks allocation

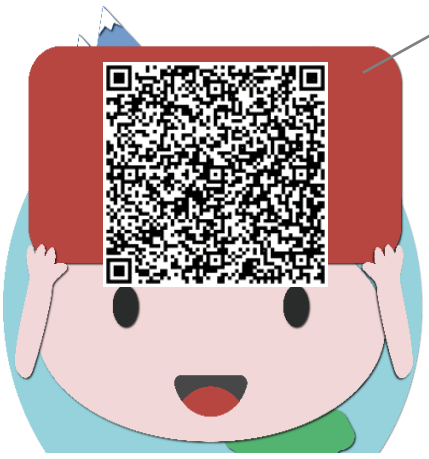


Part 1: Sampling plot

1) ❒ Tree height
2) ❒ Crown width
3) ❒ Circumference of tree trunk
4) ❒ Shrub height
5) ❒ Characteristics of woody plants
6) ❒ Vertical stratification

Part 2: Sampling point

1. ❒ Light intensity
2. ❒ Canopy density
   (densiometer; observation and category)
3. ❒ Undergrowth cover
4. ❒ Soil moisture
5. ❒ Collect soil sample (bottleful)
   (Lab work: Soil fertility and texture test)



How to use Abney level?

How to use densiometer?

To learn more...

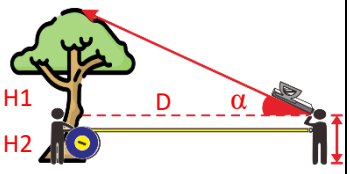
Part 1: Sampling plot

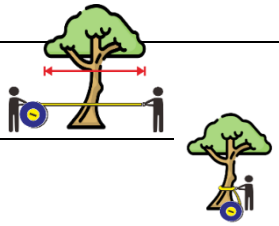
Group no. _____

After returning to the classroom, record the data on page 13-14.

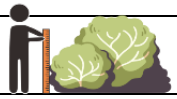
Tree (Select ONE representative tree)

Tree height	Horizontal distance between observer and the tree	〔D〕	m
	Elevation angle of the Abney level	〔α〕	°
	D tan α	〔H1〕	m
	Height from eye level of observer to ground	〔H2〕	m
	Tree height	**〔H1+H2〕**	m
Crown width			m
Circumference of tree trunk			cm





Shrub (Select ONE representative Shrub)

Shrub height	m	

Vertical stratification (Observe the overall environment of the study area to assess it.)

Vertical stratification	layer (s)

Other characteristic of woody plants

Within sampling plot, **observe and record the following woody plant characteristics.**

	Characteristics of plants	**Rough amount (tick where appropriate)**		
Tree crown	Umbrella-shaped crowns	☐ None	☐ Few	☐ Many
	Oval-shaped crowns	☐ None	☐ Few	☐ Many
Leaves	Drip-tips	☐ None	☐ Few	☐ Many
	Broad leaves	☐ None	☐ Few	☐ Many
	Waxy leaf surface	☐ None	☐ Few	☐ Many
Trunk	Straight trunks	☐ None	☐ Few	☐ Many
Roots	Buttress roots	☐ None	☐ Few	☐ Many
Stem and bark	Stem flowers/ cauliflory	☐ None	☐ Few	☐ Many
	Thin and smooth bark	☐ None	☐ Few	☐ Many
Other	Climbers	☐ None	☐ Few	☐ Many
	Stranglers	☐ None	☐ Few	☐ Many
	Fern/ shade-tolerant plants	☐ None	☐ Few	☐ Many
	Mosses and lichen	☐ None	☐ Few	☐ Many

Part 2: Sampling point

Group no. _____

After returning to the classroom, record the data on page 13-14.

Location of sampling point _____m

Light intensity 		_____ (Lux)	
Undergrowth	Undergrowth cover * Take photos of the undergrowth at the sampling point 	_____%	
	Observe and compare the undergrowth of each group along the transect, and select the most appropriate description.	Compared to other groups, your undergrowth is: The densest / dense / sparse / least sparse	
Canopy density	Canopy density *Take photos of the canopy at the sampling point 	$\frac{\quad}{25} \times 100\%$ (On-site measurements)	$\frac{\quad}{100} \times 100\%$ (Measure in the classroom)
	Canopy density (observation)	Class: _____	
Soil	Soil moisture 	_____%	
	Soil fertility **[Labwork]**	Available Nitrogen (N): _____ ppm Available Phosphorus (P): _____ ppm Available Potassium (K): _____ ppm	
	Soil texture **[Labwork]**	1) Soil sedimentation：_____ 2) Feel test：_____	
Collect soil sample		☐ Collected ☐ Not collected	