Farming System in Mui Wo (2 days)

Student Name:_____ Group:_____

Course date:_____

OBJECTIVES

- Knowledge:
  - To understand farming system (conventional farming and Controlled Environment Agriculture)
  - To examine how urban development affects farming activities
  - To assess the feasibility of sustainable farming development through application of modern agricultural technology
  - To understand the farming constraints faced by farmers
- Skills:
  - To classify land use in various farming areas
  - To conduct laboratory works of water samples
  - To analyse secondary data
- Value:
  - To develop students' awareness of the development of sustainable farming
  - To understand the impact of farming activities on the ecological environment and our responsibilities
  - Be aware the importance of sustainable farming development to the national food supply security

Relevance to the DSE Geography Curriculum

- ✪ Combating Famine – Is technology a panacea for food shortage?
- ✪ Building a Sustainable City – Are environmental conservation and urban development mutually exclusive?

STAGE 1: PLANNING & PREPARATION

➢ Prior knowledge

1. List the factors that would affect the development of farming activities.

Physical factors	Human factors

2. How to distinguish different farming land uses?

	Commercial farming	**Subsistence farming**	**Leisure farming**	**Abandoned farmland**
Scale of production*	large/medium/small	large/medium/small	large/medium/small	NA
Farming Intensity#	high/medium/low	high/medium/low	high/medium/low	NA
Crop type	Mainly _____ _____ crop variety	Mainly _____ _____ crop variety		NA

* *The size production farm varies from 1 to 35 dau chung.; 1 dau chung (674.47m^2) or approximately 1.6 standard basketball court or 8.3 standard badminton court.*

\# *related to the intensity of land utilization: higher levels of input per unit are of land (e.g. labour, capital, machinery, etc.)*

➢ When to collect data?

Date:_____ ☐Monday to Friday ☐ Saturday ☐ Sunday & Public holiday Season:_____ Solar terms:_____ Time:_____ to _____	What factors do you consider when selecting fieldwork date?
Any weather warnings & signals issued by Hong Kong Observatory in the **<u>last three days</u>**? ☐ Tropical cyclones warning signals ☐ Rainstorm warning signals ☐ Frost warning ☐ Cold weather warning ☐ Very hot weather warning ☐ Other:_____	
2. Is today ideal for fieldwork of this topic? Why?	

➢ Where to collect data?

My study areas: ☐ Area A&B ☐ Area C&D (refer to p.15)

Is Mui Wo an ideal field site of this topic? Why?	What factors would you consider when choosing the field site?

- **Enquiry Question**

Enquiry Question 1: What is the distribution of different farming land uses? Hypothesis 1: The closer to city centre, there will be more commercial / subsistence / leisure / abandoned farmland. Hypothesis 2: The farther from city centre, there will be more commercial / subsistence / leisure / abandoned farmland. Hypothesis 3: On the whole, commercial / subsistence / leisure / abandoned farmland.account for the highest proportion. What are the main locational factors of the distribution of current agricultural activities in the study area?
Enquiry Question 2: How far do farming activities affect the stream water quality?
Enquiry Question 3: What are the major farming constraints (physical and/or human) faced by the farmers in Mui Wo?
Enquiry Question 4: How far do farming technology relieve farming constraints? To a large / small extent, modern farming technology can solve the farming constraints in the study area.

Farming constraints in the study area include:	Modern farming technology include:

➢ What data to be collected and how to collect the data?

Refer to "Primary data collection methods" (Table 1) and "Equipment list" (Table 2), complete the table below.

Items			Primary data collection methods **[A-I]** (may choose more than one)	Equipment required **[1-10] (if needed)**	Operational precautions (fill in after fieldwork)
Distribution of farming land use					
Input	**Micro climate**	Sunlight (light intensity)			
		Air temperature			
		Relative humidity			
		Wind direction & speed			
	Water	Supply			
		Quality			
	Soil (e.g. texture, colour)				
	Land	**Relief**			
		Farm size			
	Other (e.g. labour, market, transport network, electricity supply, etc.)				
Process	**e.g. irrigation, pest control, weed removal, etc.**				
Output	**Useful outputs** (e.g. cash crops)				
	Useless outputs (e.g. waste water)				
Constraints					

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

Table 1 Primary data collection methods

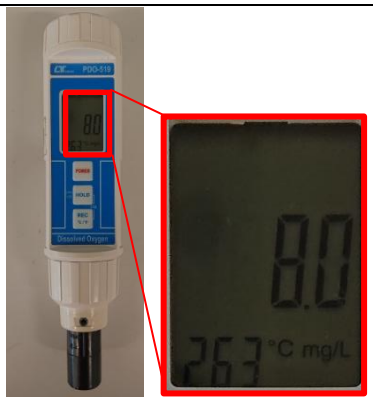
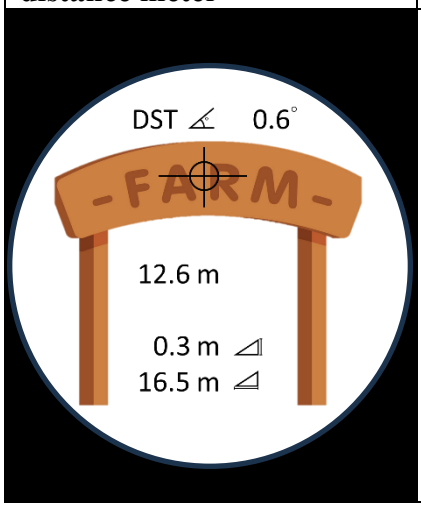
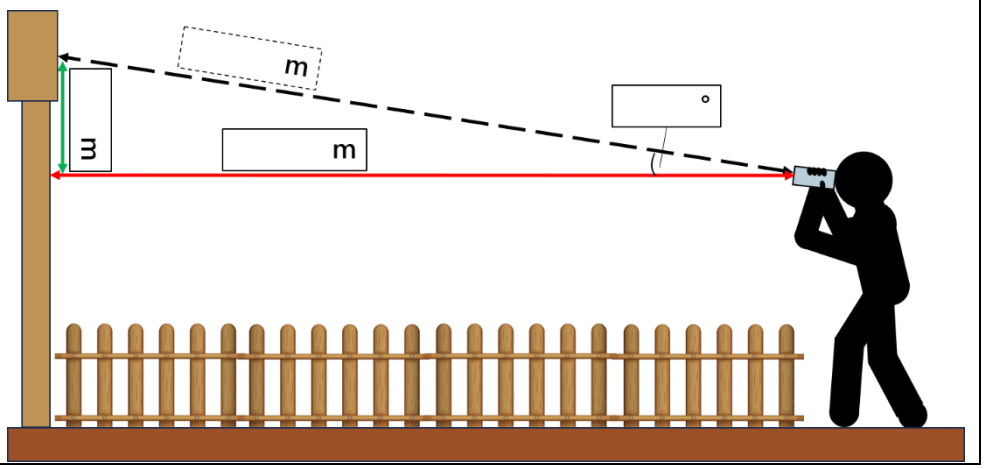
Equipment/ Tools		
1. compass	2. light meter	3. thermo-hygrometer
4. anemometer	 5. dissolved oxygen meter	6. bucket, water sample bottle, plastic bottle and gloves
7. coloured pencils	8. soil sample bottle & trowel	9. laser distance meter
10. identification guide of farming		

Table 2 Equipment/ tools for fieldwork

Use of laser distance meter

Example: Readings displayed in the laser distance meter	**What does the data displayed on the laser distance meter represent?** Fill in the number of the left image in the appropriate boxes below.
	

Steps

1. Select the main corner of the farm as set point
2. At each corner, measure the distance between the set point and the reference point.
3. Walk to another corner and measure the length of another side.
4. Calculate the area (m^2)
5. For irregular farm shape, divide the farm into simple shapes and sum their areas (e.g. rectangle, triangle, etc.)

Mui Wo farm _____	Distance between set point and reference point
Horizontal distance **(L1)**	m
Horizontal distance **(L2)**	m
Horizontal distance (L3) (if applicable)	m
Farm size	m^2

STAGE 2: DATA COLLECTION *(DATA RECORD SHEET, P.15-20)*

1. Distribution of farming land uses: Walk through your study area. Identify and classify the farming land uses. Colour the farming land uses on the map (p.15).
2. Water quality: Collect water samples and examine the water quality. Record the results on p.16.
3. Operation of farming system: Walk through your study area. Observe the designated farming land use. Record the results on p.17.
4. Interview farmers in Mui Wo and record the result on p.19.
5. Collect soil samples from designated farm and conduct experiment at centre (p.20).

STAGE 3: DATA PROCESSING AND PRESENTATION

Process the data below

1. Land use distribution	▪ Combine the maps of areas AB and CD to show the distribution of farming land uses by _____.
2. Amount and percentage of farming land use	▪ Use transparent grid sheet to count the area of farmland. ▪ Count the number of different farming land uses ▪ Calculate the percentage of different farming land uses ▪ Use a _____ to show the above percentage
3. Compare water quality of water inlet and outlet	▪ Refer to the scoring table, assess the water quality data (p.16) as scores. Calculate the total assessment score and the pollution level. ▪ Use _____ to compare the water quality of water inlet and outlet

STAGE 4: DATA ANALYSIS & INTERPRETATION

1. (a) According to the farming land use map, land use data and field data,
   (i) Describe and explain the **current distribution** of farming land uses in Mui Wo.
   (Are your hypotheses of Enquiry Question 1 on p.4 valid?)
   (ii) Describe and explain the characteristics of **current** farming system of Mui Wo.
   (b) Discuss the favourable locational factor(s) to the farming activities **in the early 1970s**.
   (use aerial photo of Mui Wo (1974) and field data)

1(a) Hint: Which land use accounts for the highest proportion? Which accounts for the least? What are the characteristics of the spatial distribution of different agricultural land uses? What location factors lead to this spatial distribution pattern?

2. Refer to the results of the water quality of **Water Inlet** and **Water Outlet** (p.16), are the result consistent with your hypothesis of Enquiry Question 2 (p.4)? Discuss how far do farming activities affect the water quality.

3. Based on your observations, field data (physical inputs – weather, soil, etc. on p.17) and interview results (p.19), discuss the major limitations to local farming and give suggestion to overcome those limitations.

Hint: Refer to your hypothesis of Enquiry Question 3 (p.4), are your assumptions valid? Which constraints (natural/human) are greater? (e.g. yield, production cost, labour input or other aspects)

4. Refer to the field data (p.17) and the visit of hydroponic system,
   (a) Compare the merits& demerits of conventional farming & controlled environment agriculture (CEA).

Hint: From field evidence, what's the constraint(s) of conventional farming? How can CEA help overcome those constraints and what's their cost-effectiveness?

   (b) (i) Refer to Enquiry Question 4 (p.4), discuss to what extent do modern farming technology can solve the farming constraints in Mui Wo.
   (ii) Which hydroponic technique is most suitable to develop in Hong Kong? Why? (refer to p.18)

Hint: Which hydroponic technique is most suitable to cope with the demand & constraints of Hong Kong? (consider from the perspective of cost-effectiveness, feasibility, etc.)

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?		

Further study

From today's result, what other aspects of "farming system of Mui Wo" can be explored? Formulate and elaborate your study plan (e.g. field site/ date/ time/ hypothesis/ data items/ sampling methods, equipment, etc.)

Homework

After the fieldwork, complete the field trip diary (p.13-14) as a means to consolidate this fieldwork experience and reference for revision of field-based question.

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 "**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 "**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 "**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			**Non-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.*			➢ *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)

Farming system in Mui Wo

My Field Trip Diary

- Related modules: _____
- Key point of fieldwork/topic: _____

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

- Primary data:

Strategies of data collection	Data collected	Equipment/ Instrument *(if any)*	Merits☺/ Demerits☹ of the data collection strategy *(give examples)*	Suggestion for improvement *(give explanations)*
❑ Measurement				
❑ Observation				
❑ Counting				
❑ Questionnaire/ Interview				
❑ Other (if any)				

- Secondary data:

Data collected	Use	Obtained from
Apart from the above, what other supplementary information would be necessary to respond to the fieldwork topic?		

➢ Sampling method (if any):

Sampling method	Applied during data collection of	Merits☺/ Demerits☹

➢ Data processing and presentation:

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

➢ For deeper learning or further study, I suggest modify the following aspects:

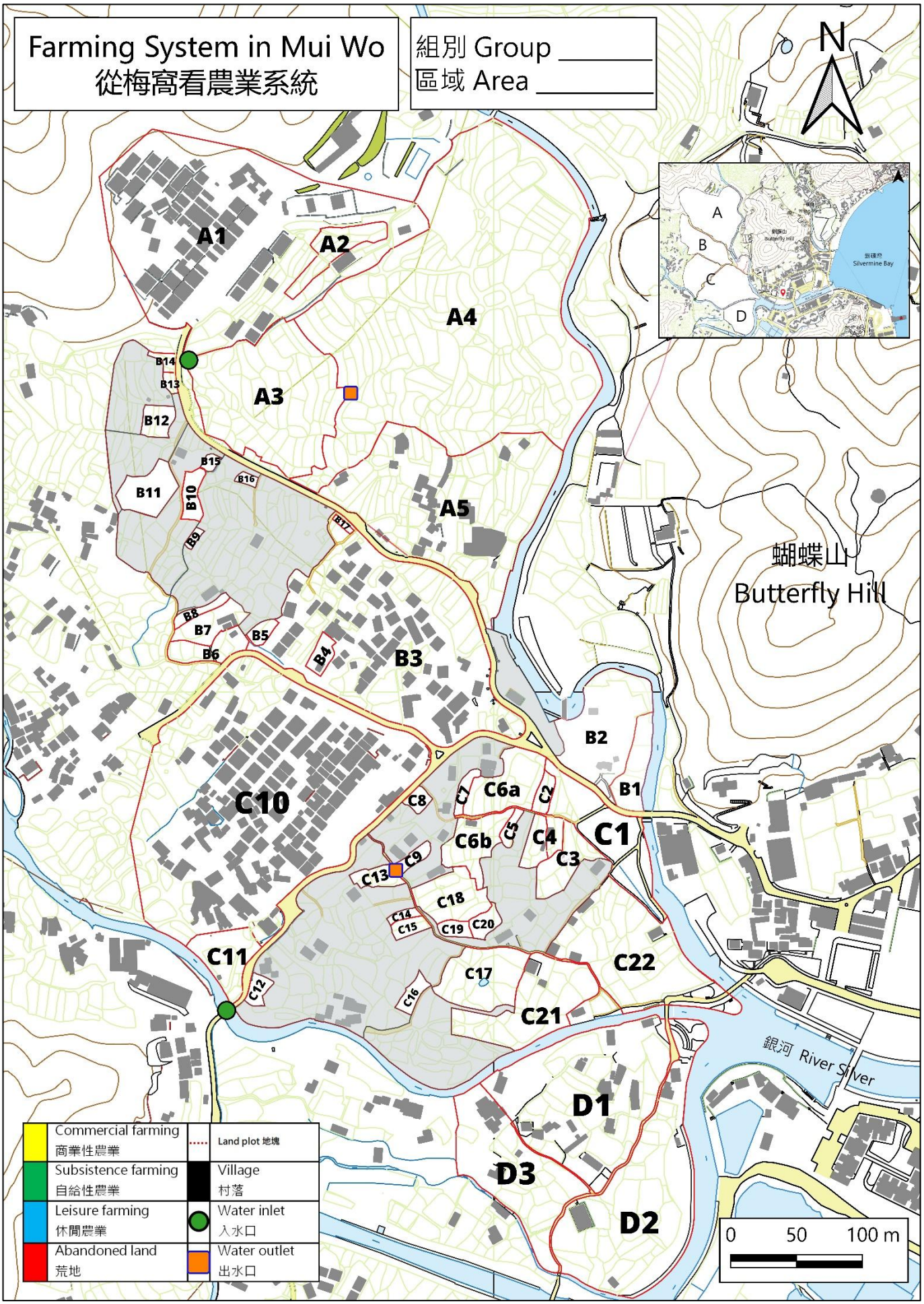
		Suggestion (give examples)
❑	Key point of fieldwork/ topic	
❑	Data to be collected and method of data collection	
❑	Date and time of fieldwork	
❑	Field site	

Part 1: Distribution of farming land uses

DATA RECORD SHEET

Farming System in Mui Wo
從梅窩看農業系統

組別 Group _____
區域 Area _____



DATA RECORD SHEET

Part 2: Water quality

Each group will collect water samples and examine the water quality.

Items		Area AB / CD (circle as appropriate)	
		Water inlet	**Water outlet**
Fieldwork	**Smell**	None / Slight / Moderate/ Strong	None / Slight / Moderate/ Strong
	Floating matter	None/ Some/ Plentiful/ Abundant	None/ Some/ Plentiful/ Abundant
	Dissolved oxygen level (mg/L)		
Labwork	**Turbidity**	Low (Extremely clear)/ Fairly low (Fairly clear)/ Moderate (Murky)/ High (Extremely murky)	Low (Extremely clear)/ Fairly low (Fairly clear)/ Moderate (Murky)/ High (Extremely murky)
	pH value		
	Ammonia content (ppm)		

Score	0	1	2	3
Smell	None	Slight	Moderate	Strong
Floating matter	None	Some	Plentiful	Abundant
DO level (mg/L)	Very high [>7.0]	High [5.1-7.0]	Low [3.0-5.0]	Very low [<3.0]
Turbidity	Low (Extremely clear)	Fairly low (Fairly clear)	Moderate (Murky)	High (Extremely murky)
pH value	Neutral (6.75-7.24)	Slightly acidic (4.95 – 6.74) Slightly alkaine (7.25 – 8.04)	Acidic (4.05 - 4.94) Alkaline (8.05 - 9.04)	Strongly acidic (< 4.04) Strongly alkaline (> 9.05)
Ammonia content (ppm)	≦0.50	0.51 – 2.00	2.01 – 4.00	>4.00

Total score	Pollution level
0–3	**Clean**
4–8	**Slightly polluted**
9–13	**Moderately polluted**
14–18	**Severely polluted**

Item	Area A&B		Area C&D	
	Water inlet	**Water outlet**	**Water inlet**	**Water outlet**
Total score				
Pollution level				

DATA RECORD SHEET

Part 3.1: Operation of farming system

Farming system			Mui Wo farm 1: _____	Mui Wo farm 2: _____	Controlled Environment Agriculture
Physical factors	Micro climate*	Light intensity (Lux)			
		Air temperature (℃)			
		Relative humidity (%)			
		Wind direction & wind speed (m/s)			
	Water	Supply	Rain/River/Reservoir/Tap water	Rain/River/Reservoir/Tap water	Rain/River/Reservoir/Tap water
		Quality	Water sample test		N/A
	Soil	Colour	Light/dark,yellow/brown	Light/dark,yellow/brown	N/A
		Texture	Sandy / Clayey	Sandy / Clayey	N/A
	Land	Relief	Flat / Undulating	Flat / Undulating	Flat / Undulating
		Area of farmland (m^2)			
Human factors	**Labour intensity** (farmers' no. & age, farm size, farming technology)		Adequate/ Inadequate/ uncertain	Adequate/ Inadequate/ uncertain	Adequate/ Inadequate/ uncertain
	Transport network (connect to main road)		Yes / No	Yes / No	N/A
	Electricity supply		Adequate/ Inadequate	Adequate/ Inadequate	Adequate/ Inadequate
Processes#	**Irrigation**		Manual / Mechanized	Manual / Mechanized	Manual / Mechanized
	Soil fertilization		Organic / Chemical	Organic / Chemical	Organic / Chemical
	Weed removal		Simple Tools / Machinery / NIL	Simple Tools/ Machinery/ NIL	Simple Tools / Machinery / NIL
	Pest removal				
	Ploughing & harvesting		Simple Tools / Machinery	Simple Tools / Machinery	Simple Tools / Machinery
	Fallowing		Yes / No	Yes / No	Yes / No
	Evaluate the level of technology		**Higher / Lower**	**Higher / Lower**	**Higher / Lower**
Useful outputs	**Variety of produce** Few(1-3)/ Several(4-6)/ Many(>6)				
	Density of cropping		High/Low	High/Low	High/Low
	Main produce @				
	Value of crops		High/Low	High/Low	High/Low
	Uses		Own use / For sale	Own use / For sale	Own use / For sale
Useless outputs	e.g. waste, waste water, pollutants				

* Only need to measure ONE FARMLAND # *refer to "Identification Guide of Farming"* @ *leafy vegetables, melons, beans, tubers, fruits, spice, others*

DATA RECORD SHEET

Part 3.2: Controlled Environment Agriculture (CEA)

Observe and compare the characteristics and operating conditions of hydroponic systems in Exhibition Room.

What techniques are used for the hydroponic system? Fill in their name/ code in the table below.

Hint/ characteristics	System (Name)
1. Most simple system/ lowest technological input/ lowest cost	
2. The Controlled Environmental Hydroponic Research and Development Centre, jointly established by The Agriculture, Fisheries and Conservation Department (AFCD) and the Vegetable Marketing Organization (VMO) / Commercial farming in Hong Kong/ factory farm adopt this technique/ capable of vertical development /vertical farming	
3. Use organic matter as source of nutrient	
4. Produce smaller water droplets (~10μm)/ latest technique/ capable of operation in zero gravity	
5. Produce larger water droplets (~50μm)/ new technique	
6. Water level rises and falls periodically	
7. Higher demand for oxygen & aeration	
8. Common irrigation technique used in semi-arid regions (e.g. Sahel of Africa)	

Part 4: Interview the farm owner

Refer to Enquiry Question 3 (p.4), choose **ONE** of the following factors to set a questionnaire with **THREE** questions. You may take the following tips as references:

1) Characteristics and operation of the farming system;
2) Major difficulties and constraints that the farmers are encountering; and
3) Solutions for those difficulties and constraints, etc.

Background information	**Farmer:**	**Operation history:**
Choose ONE of the following factors: ☐ Weather/ Climate ☐ Soil ☐ Water supply ☐ Land supply ☐ Labour ☐ Market ☐ Government policy ☐ Community co-operation ☐ Other: _____	**Question 1:**	
	Question 2:	
	Question 3:	

DATA RECORD SHEET

Part 5: Soil quality

1. Soil pH

Conduct experiment to understand the pH of soil sample.

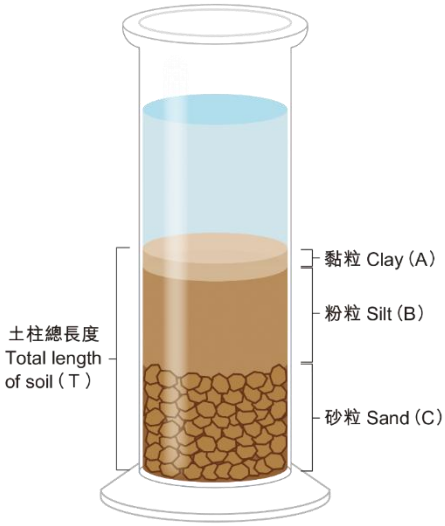
	Soil sample
pH value	

2. **Soil fertility test** - use soil NPK meter to measure the nutrient concentration of the soil sample.

Soil nutrient	Available nitrogen (N)	Available phosphurus (P)	Available postassium (K)
Content (mg/kg)			

3. **Soil texture test (sedimentation method)**

Item		Result
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

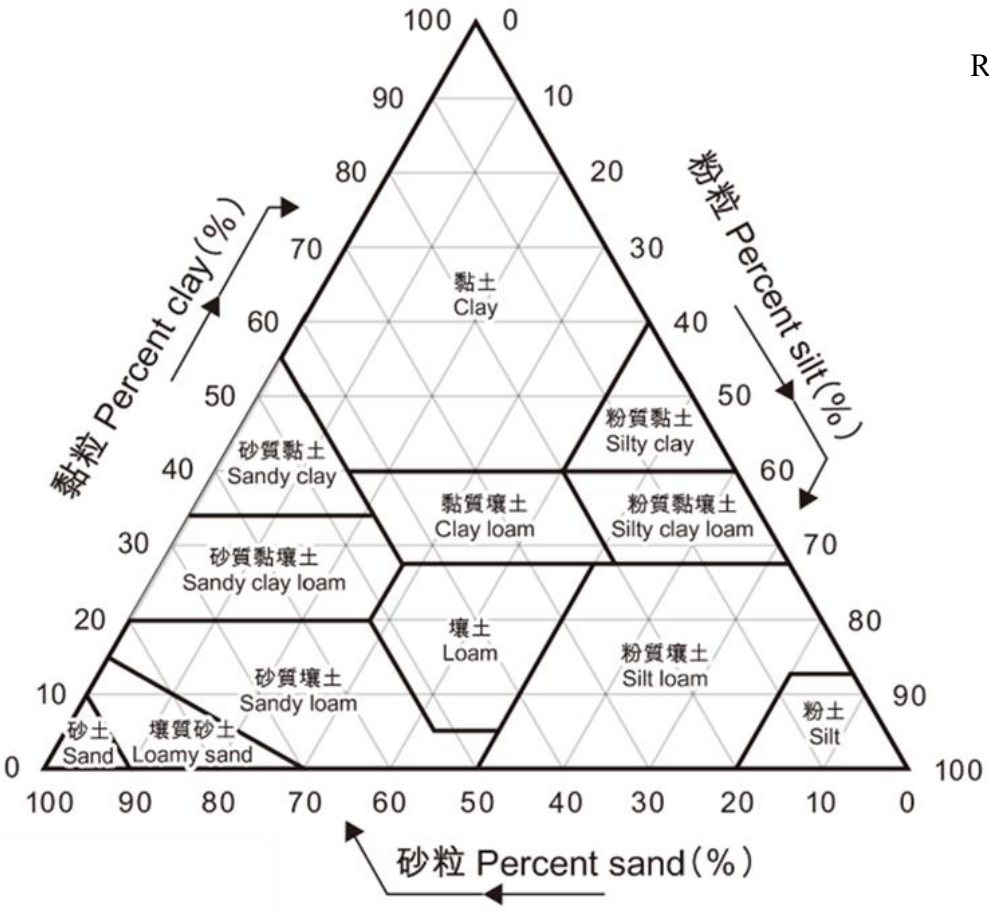


Figure 3 Soil texture triangular graph