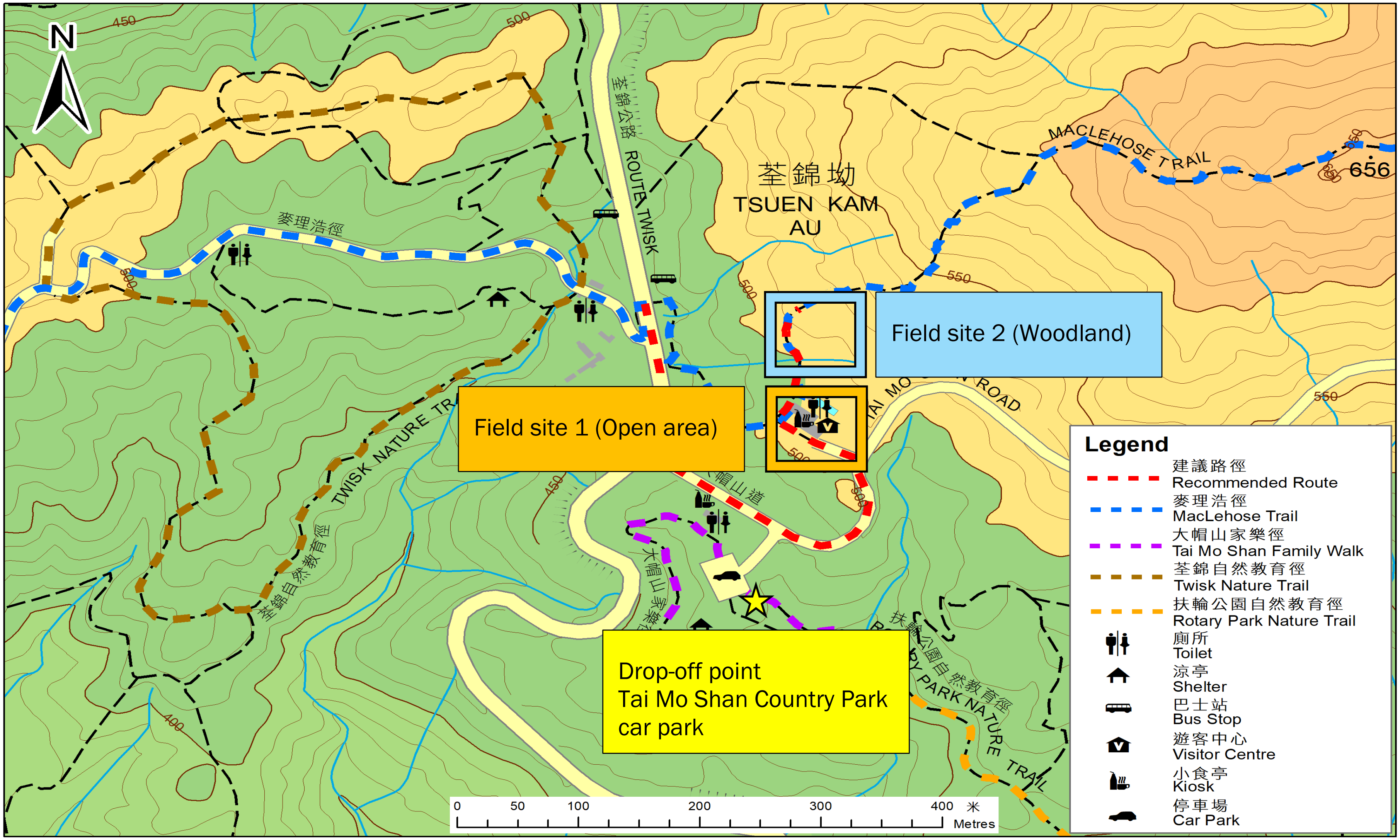
WOODLAND ECOSYSTEM

FIELD STUDY HANDBOOK

1b. Safety Code and Code of Conduct

A. Wear PE uniform, trainers and hats.
B. Bring enough drinking water and outdoor equipment including organic mosquito repellent and rain gear.
C. Do not leave the group without the permission of teacher/instructor.
D. Pay attention to the surroundings.
E. When conducting tree survey, one should pay attention to the insects and animal which inhibit on branches and tree truck. Avoid touching, disturbing or hurting them.
F. Do not take away anything from the nature. Fallen parts of plants can be picked up for observation only. They should be placed back to the original location.
G. Do not eat or pick any branches, leaves, flowers or fruits of the plants.
H. Do not litter or pollute the natural environment.
I. Care for the environment and take your litter home
J. Seek teacher/instructor’s help if needed.

2. Map



Map No. M_R_2021_003_TMS

Group's Scientific Investigation

1. What is the investigation topic of your group?

1. Compulsory

a. How does the micro-climate change in woodland and open area? And why does this change exist?

2. Choose ONE statement and explain your point of view based on your data and research.

☐ The woodland has high species richness but less species evenness.

☐ Woodland are layered, with different plants collecting light from different level. Only two layers of woodland structure can be found in the site.

☐ Invasive plants species is more competitive and dominant compare with native plant species in the site.

☐ The site is an example of plantation.

☐ Other: ____

2. What is your hypothesis?

____

____

____

____

____

3. What kind of data do you need to collect?

Types of factors	The chosen factor	The reason why you have to collect this kind of data (Any assumptions based on prior knowledge?)
Biotic/Abiotic	____________________	____ ____
Biotic/Abiotic	____________________	____ ____
Biotic/Abiotic	____________________	____ ____
Biotic/Abiotic	____________________	____ ____
Biotic/Abiotic	____________________	____ ____
Biotic/Abiotic	____________________	____ ____

4. What is the advantage and disadvantage of line transect sampling?

____

____

____

____

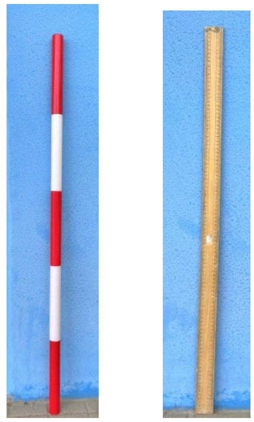
____

Equipment checklist		
Item	**Quantity**	**✓**
Field guide and photo-taking reminder		
Plant data record sheet		
Abiotic data record sheet		
Map		
Compass		
Plants identification kit		
Worksheet		
Clipboard		
Transect line (30m)		
Ranging pole		
Data logger or light meter, anemometer, electronic thermometer, thermohydrometer		
2m measuring tape		
Caliper		
Clinometer or laser rangefinder		
Spherical Crown Densiometer (optional)*		
Gloves (if needed)		

Photos of equipment

1. Transect line (30m)

2. Ranging pole or 1m ruler



3. Data logger or Thermometer and Thermohydrometer

4. Lux meter

5. Anemometer

6. Clinometer or laser rangefinder

7. Caliper

8. 2m measuring tape

9. Spherical Crown Densiometer (optional)

1a. Field work

1. Measure the abiotic factors in field site 1 **(open area)**:
   - Temperature, humidity, light intensity and wind speed
   - Measure each factor 3 times, take the average and complete abiotic data record sheet

Figure 1. Using the appropriate tools to measure the abiotic factors in open area

2. Measure the abiotic factors in field site 2 **(woodland)**:
   - Temperature, humidity, light intensity, wind speed and crown coverage
   - Measure each factor 3 times, calculate the average and complete abiotic data record sheet

Figure 2. Using appropriate tools to measure the abiotic factors in woodland

1. The needs of multiple-measurement

Random error may be caused by slight fluctuations in an instrument and the environment. In order to address random error, scientists **utilized repeated measurements (replication).**

Replication refer to repeating a measurement many times and taking the average.

3. Set up one/two 20m transect line(s) in field site 2

Figure 3. Set up one/two 20m transect line(s) in the woodland

2. Line Transect Sampling

Plants often have a very patchy distribution, the ability to cover a large area of ground with modest resources is an important advantage of line transects.

4. Examine the **plants** which touch the transect or beneath it within 1 m, take photos and complete plant data record sheet:

   *Tree
   - Diameter at Breast Height (DBH), height, average crown spread, species name and corresponding positions on transect line
   - Organisms (fungi, mosses) growing on trees

   *In general, a tree is defined as a plant with the trunk diameter of at least 95mm at a height of 1.3m above the ground level.

   Shrub
   - Height and corresponding positions on transect line
   - Organisms (fungi, mosses) found on shrubs
   - Species identification (optional)

   Herbs and climbing plants

   - Height and corresponding positions on transect line
   - Organisms (fungi, mosses) found on herbs and climbing plants
   - Species identification (optional)

Figure 4. Tree beneath the transect line within 1m

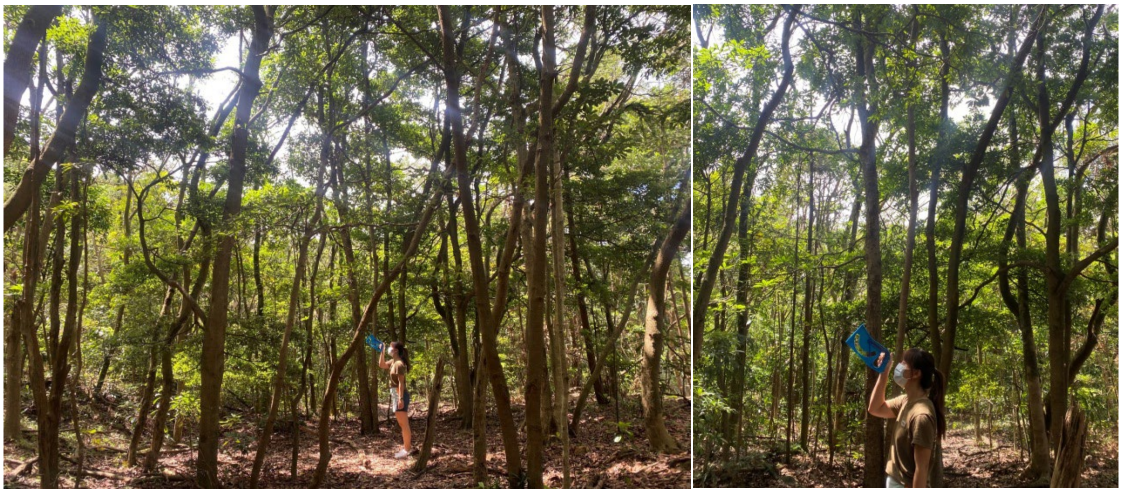


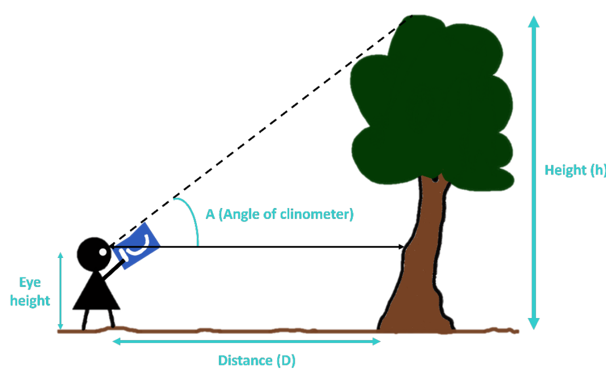
Figure 5. Using the clinometer to measure the distance between the tree and the ground

3. Tree Height Measurement

a) Choose a point where you can see the top of tree. The distance between the point and tree should be at least or about the tree height.
b) Measure the distance between the tree and the point and the angle between the top of tree and the point using the clinometer.
c) Look through the clinometer with one eye and at the top of tree with another eye. Line up the crosshair in the clinometer with the top of the tree.
d) Read the scale in the clinometer. This represents the angle of clinometer.
e) Calculate the tree height using the equation:

Tree height = tan [Clinometer reading (º)] × Distance to tree + Eye height above the ground

For young tree, shrub, herb and climbing plants (about 1.3 m or below tall), please use measuring tape to measure the height.



Example:

Example:

Distance to tree = 25m

Clinometer reading = 15º

Height of eye above ground = 1.5m

Tree height = tan15º x 25m + 1.5m = 8.2m

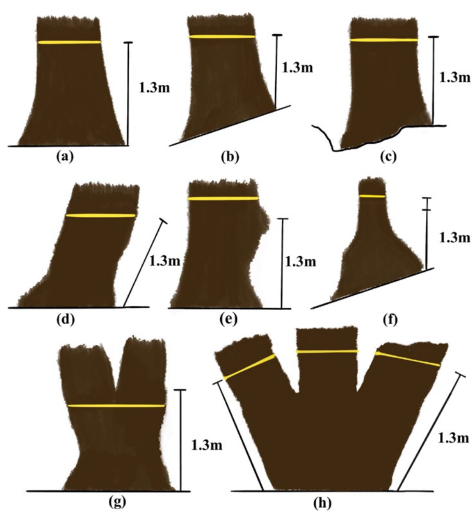
Figure 6. Using measuring tape (middle) or caliper (right) to measure DBH

4. Diameter at Breast Height (DBH)

DBH refers to the diameter of tree trunk measured at breast level (1.3m). It is a standard and the most common method of measuring tree growth apart from tree height. DBH can be calculated from the circumference of the trunk measured by measuring tape.

DBH = Circumference / Pi (3.14)

***** For young tree or tree seedling, please use caliper to measure DBH directly.



DBH measurement in different situations: (a) level ground; (b) slope; (c) uneven ground; (d) bending or inclined tree trunk; (e) tree trunk with a limb, bulge or other abnormality; (f) tree trunk with buttresses; (g) tree fork exactly at breast height; (h) tree with multiple stems.

Photo-taking reminder

a. Overall views showing the plant from different angles
b. For tree, medium shot of the tree and close up view of the trunk (refer to Example 1)
c. For shrub, climber and herb, close up view of stem, leaf (upper surface and underside) and flower/fruit if possible (refer to Example 2)
d. For lichens and mosses, medium shot of the tree and close up view of the lichens or mosses (refer to Example 3)

***Remember to take photos for ALL recorded plants species**.

Example 1

Example 2

Example 3

5. Data collection: Abiotic data record sheet

Class: ________ Group number: _______ Leader's name: __________________ Date: _______________

Today's temperature: _______________ Today's humidity: ________________ Time: _________________

The locations of woodland and open area, please refer to the map on p.3. Student are suggested to measure abiotic factor at the open area near toilet or visitor center.

Temperature (°C)	Woodland	Open area
1		
2		
3		
Average value		
Humidity (%)	**Woodland**	**Open area**
1		
2		
3		
Average value		
Wind speed (km/h)	**Woodland**	**Open area**
1		
2		
3		
Average value		
Light intensity (lux)	**Woodland**	**Open area**
1		
2		
3		
Average value		

6. Data collection: Tree data record sheet

Class: ________ Group number: _______ Leader's name: __________________ Date: _______________

- For trees (at least 95 mm in DBH), you may make use of tree tag for filling in column B.
- For other plants, it is optional to fill in columns B & D and no input is needed in columns E and F.
- Remember to take photos for ALL recorded species.

Today's temperature: _______________ Today's humidity: _________________ Time: _______________

A. Positions on the transect line (m)	B. Species name	C. Type of plants	D. Origin of plants	E. Diameter at Breast Height (mm) *Measure the tree trunk at 1.3m above ground level.	F. Average Crown Spread (m)* (If Spherical Crown Densiometer is available)	G. Height (m)	H. Remarks (mosses/lichen/ animals found on the plant)
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				
		Tree/ shrub / climber/ herb	Native/ Exotic				

		Tree/ shrub / climber/ herb	**Native/ Exotic**				
		Tree/ shrub / climber/ herb	**Native/ Exotic**				
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		Tree/ shrub / climber/ herb	**Native/ Exotic**				
		Tree/ shrub / climber/ herb	**Native/ Exotic**				
		Tree/ shrub / climber/ herb	**Native/ Exotic**				

Think over

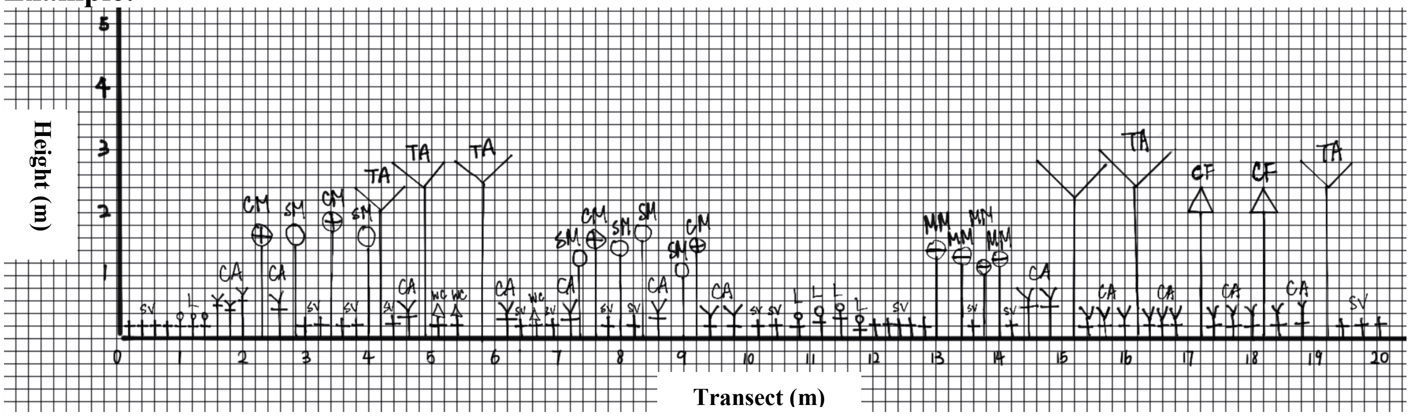
1. **What is the plant abundance in the site?**
2. **Report to your teacher briefly, how many plant species did you find?**
3. **Do you think the site has high plant species evenness?**
4. **What are the relationships among different plant species in the site?**

7. Data analysis (1)

Class: ________ Group number: _______ Leader's name: ____________________ Date: _______________

A. Profile diagram. Based on the data in record sheet A and B and your own research, illustrate a profile diagram of your investigation area on a **graph paper** and answer the following questions.

Example:



TA= Taiwan Acacia (台灣相思)	MM= Many-nerved Machilus (刨花潤楠)	L= Litsea (豺皮樟)
CA= Chinese Alangium (八角楓)	SM= Short-flowered Machilus（短序潤楠）	CF= China Fir (杉木)
WC= Wild Coffee （山大刀)	CM= Chekiang Machilus（浙江潤楠)	SV=Sweet Viburnum (珊瑚樹)

B. Short questions

1. How many plant species did you find?

____.

2. What is/are the dominate species according to your data?

____.

C. Tick the correct statements about your observation. (Can choose more than one option)
In the site,

- ☐ Plant diversity is high.
- ☐ Plant diversity is low.
- ☐ Exotic trees are relatively taller and have greater DBH than native trees.
- ☐ Native trees are relatively taller and have greater DBH than exotic trees.
- ☐ Trees are evenly spaced.
- ☐ Trees are unevenly spaced.

8. Discussion (1)

a. How does the micro-climate change in woodland and open area? And why does this change exist?

9. Discussion (3)- Chosen topic on p. 3

b.____

WOODLAND ECOSYSTEM

POST-FIELD STUDY WORKSHEET

Exercise A: Please fill in the number of species in the table and calculate the relative abundance of species.

The calculation of Relative Species Abundance:

The number of species from one group / the total number of species from all groups X 100%

(If the species with the greatest relative abundance account for a smaller proportion, and the species with the lowest relative abundance account for a larger proportion, the area would be more "even", and a more "even" area would have a greater level of biodiversity)

Tree Species	Transect A	Transect B	Transect C	Transect D	Transect E
e.g. Machilus breviflora	(%)	(%)	(%)	(%)	(%)
	(%)	(%)	(%)	(%)	(%)
	(%)	(%)	(%)	(%)	(%)
	(%)	(%)	(%)	(%)	(%)
	(%)	(%)	(%)	(%)	(%)
	(%)	(%)	(%)	(%)	(%)
	(%)	(%)	(%)	(%)	(%)

1. According to the above table, what is the species richness (tree) in each transect line?

   A: __________ B: ____________ C: ____________ D: ____________ E: ____________

2. Which transect area has the greatest species evenness? __________

(Advanced) Simpson's Diversity Index

Exercise B: Simpson's Diversity Index

Simpson's Diversity Index is a measure of diversity which considers the number of species present, as well as the relative abundance of each species. As species richness and evenness increase, so diversity increases.

(i) **Simpson's Diversity Index**

$$D = \frac{\sum n_i\,(n_i - 1)}{N(N-1)}$$

Where:
n is the number of individuals displaying one trait (e.g. the number of$N(N$-1) individuals of one species)
N is the total number of all individuals
$\boldsymbol{D}$ ranges between 0 and 1. With this index, 1 represents infinite diversity and 0, no diversity.

Tree Species	Number (n) of transect A	$\boldsymbol{n}$-1	n(n-1)
Total		$\sum$	

Write down the Simpson's Diversity Index for each transect:

Transect A; $D =$ ______________________________

Transect B; $D =$ ______________________________

Transect C; $D =$ ______________________________

Transect C; $D =$ ______________________________

Take-home exercise: Using dichotomous key to identify common plants in woodland of Hong Kong

Name: ________________________ Class: __________ (   ) Date: __________________

A. The following photos show the four common plants in the field study site of Tai Mo Shan Country Park. Put a tick in the appropriate boxes to show the features of each plant species.

Short-flowered Machilus
Machilus breviflora

Schima
Schima superba

Turn-in-the-wind
Mallotus paniculatus

China Fir
Cunninghamia lanceolata

*All photos credits to Agriculture, Fisheries and Conservation Department.

	Leaf underside white	**Leaf underside not white**	**Board Leaf**	**Needle Leaf**	**Margin toothed**	**Margin entire**
Short-flowered Machilus *Machilus breviflora*						
Schima *Schima superba*						
Turn-in-the-wind *Mallotus paniculatus*						
China Fir *Cunninghamia lanceolata*						

A. Using the information from the table in part a, complete the following dichotomous key:

1a. Leaf underside white --------------------

1b. Leaf underside not white -------------------- 2

2a. The plant has single flower ----------------

2b. The plant has cluster of flowers ---------------- 3

3a. The plant has smooth margin -----------------

3b. The plant has toothed margin ----------------