

Study of Woodland Ecosystem

INTRODUCTION

Woodland provides an unlimited source of knowledge to be explored. You may find that all ecological concepts you have learnt are available in a mature woodland - Energy flow, nutrient cycles, successions, effects of human impacts, symbiotic associations, competition, stratification, adaptation, natural selections and so on. Woodland is a highly competitive ecosystem, you can see how do the living organisms use various methods to struggle for limited resources such as food, light and space.

In this study, you will be divided into two groups and study two different woodlands. Same procedures are to be followed. The findings from different woodlands will then be shared and compared. Because two woodlands have different origins, physical factors and biotic factors are also different. Try to find out the differences and explain them.

We are not doing a formal ecological research, so identification of all encountered animals and plants to species level is not necessary. Identify to species level only for those important species in the woodlands. For others, use common names or assign number to different species such as tree 1, tree 2, shrub 1, butterfly 1 etc.

Similarly, very accurate data and a very large sample size are also not necessary, our sole purpose is learning. Nevertheless, you have to be aware of the limitations of your study.

Make sure that you understand every piece of work suggested in this manual, that means you know what to do, how to do, where to do, when to do and why to do. You must be well prepared before the field trip because you would not have extra time to consider the above questions in the field.

Impose minimum disturbance to the woodlands. We are collecting data, not collecting lives; we are observing, not killing. Collect samples only when necessary. For the purpose of detailed identification, one from each species is enough. Whenever possible, identify in the field.

Field Work

A. Transect

Run a 20 m long transect across an area which can represent the woodland.

B. General observation

1. Record:

- a. Recent weather conditions.
 - b. Aspect along the transect line.
 - c. Approximate altitude of the woodland (see the map).
 - d. Approximate size of the woodland. (see the map)
 - e. Surrounding environment: grassland, road, trail, village etc..
 - f. Possible human impacts on the woodland.
 - g. Number of strata.
2. Along the transect line, measure gradient of the slope at 2 m intervals, the information will be used to draw profile diagram. (see appendices)

C. Soil and litter sampling

1. Select an area along the transect line which is representative, put a 50 x 50 cm quadrat on the area.
2. Collect all litter within the quadrat and transfer it to a plastic bag with label. This will be brought back to laboratory for further investigation. Remember to wear a pair of gloves in order to protect your hands from aggressive invertebrates such as centipede.
3. Dig out the surface soil layer (about 3-5 cm deep) and collect it, about 400 g is enough.

D. Animal sampling

1. Use the air net to catch flying animals near the transect line.
2. Search for small animals in different micro-habitats such as under cracked bark, on leaf surfaces, under leaf sheaths, in flowers, in fruits, in dead woods, in cow dung etc..
3. Distribution of spider webs and animal damage on leaves can provide useful information of animal distribution.

E. Vegetative survey

1. Trees

- a. Trees which touch or have their perpendicular crown projections overlying the transect line should all be included in your investigation. (see appendix 2)
- b. Measure the followings for each tree included in your investigation:
 - (i) Height (see appendix 2).
 - (ii) Diameter of trunk at breast height.
 - (iii) Crown length and crown width (see appendix 2)
 - (iv) Corresponding position on the transect line.
- c. You do not have to identify every trees encountered, but you should be able to distinguish different tree species and this should be indicated in the profile diagram.
- d. Epiphytes on a particular tree along the transect line should also be recorded. Brief description is enough

2. Shrubs

- a. Record all shrubs which touch, overlies or underlies the transect line.
- b. For each shrub, record their heights and corresponding positions on the transect.
- c. Identification to species level is again not required, except for the particularly abundant one.

3. Herbs, grasses, ferns and others

Include all herbs, grasses, ferns, mosses, fungi and other lower plants growing near the transect line. Record only approximate number of species encountered and notice the most abundant species (if present).

F. Physical factors

1. Use the light meter to measure light intensity:
 - (a) above canopy layer,
 - (b) below canopy layer but above shrub layer, and
 - (c) below shrub layer.
2. Use the digital thermohygrometer to measure humidity:
 - (a) on surface of litter layer,
 - (b) in open air within the woodland, and
 - (c) in open air outside the woodland.
3. Use the digital thermohygrometer to measure temperature:
 - (a) on the surface of litter level,
 - (b) in open air within the woodland, and
 - (c) in open air outside the woodland.
4. Use anemometer to measure average wind speed inside and outside the woodland.

Laboratory Work

A. Soil analysis

1. Place the soil sample into the white sorting tray and sort out the animals for identification and count.
2. Examine colour, smell and nature (soft, hard, loose, sticky...) of the soil.
3. Place few grams of soil in a petri dish, add some water and test for pH by the specialized pH paper.
4. Put soil into a weighed crucible, weigh. Put the crucible with soil into a oven operating at 105 °C. Until it is dry (about few hours later), cool it and then weight. Calculate water content of the soil.
5. Burn the dry soil by the gas burner for about 20 mins.. Until it is cool, weigh (do not put the hot crucible on working table or bench directly, put it only on bench mat!). Calculate organic matter content of the soil.

B. Litter analysis

1. Weigh the litter collected. Record in terms of mass per unit area of land. Also describe the litter in respect of degree of decomposition, composition, colour, smell etc..
2. Place the litter in a tray and sort out the animals. Use forceps to sort, beware of aggressive invertebrates. Identify and count them.

C. Analysis of collected plants and animals

1. Identify the plants and animals you brought back from the field. Use the stereo-microscope to study structure of the small animals and plants.
2. By studying body morphology of the living organisms, try to find out adaptive features shown by the living organisms collected. Adaptive features can be found in respiratory organs, feeding organs, organs for attachment and locomotion, organs for defending against enemies and organs for preventing desiccation.

Record sheets

School / Group : _____

Members : _____

Date of investigation : _____ Time of investigation : _____

Recent weather conditions : _____

Profile diagram data()

| | | | | | | |
|-------------------------|--|--|--|--|--|--|
| Position along transect | | | | | | |
| Gradient | | | | | | |
| Remarks | | | | | | |

| | | | | | | |
|-------------------------|--|--|--|--|--|--|
| Position along transect | | | | | | |
| Gradient | | | | | | |
| Remarks | | | | | | |

General description

| | Woodland 1 | Woodland 2 |
|--------------------------|------------|------------|
| Aspect of transect | | |
| Altitude of woodland | | |
| Approx. area of woodland | | |
| Surrounding environment | | |
| Possible human impacts | | |
| No. of strata | | |

Physical factors

| | | Woodland 1 | Woodland 2 |
|--------------------------|------------------------------|------------|------------|
| Light Intensity (Lux) | Above canopy layer | | |
| | Above shrub layer | | |
| | Below shrub layer | | |
| Temperature (°C) | On litter layer | | |
| | Open spaces in woodland | | |
| | Open spaces outside woodland | | |
| Humidity (%) | On litter layer | | |
| | Open spaces in woodland | | |
| | Open spaces outside woodland | | |
| Wind Speed | Inside woodland | | |
| | Outside woodland | | |

Soil and litter

| | | Woodland 1 | Woodland 2 |
|--------|-------------------------------|------------|------------|
| Soil | Colour | | |
| | pH | | |
| | Water content (%) | | |
| | Organic mater content (%) | | |
| Litter | Colour | | |
| | Smell | | |
| | Composition | | |
| | Degree of decomposition | | |
| | Abundance (g/m ²) | | |

Tree data

(Woodland 1)

(Woodland 2)

| | Tree name | Position | Tree height | Trunk diameter | Crown length | Crown width |
|----|-----------|----------|-------------|----------------|--------------|-------------|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
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| 8 | | | | | | |
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| 11 | | | | | | |
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| 16 | | | | | | |
| 17 | | | | | | |
| 18 | | | | | | |
| 19 | | | | | | |
| 20 | | | | | | |

| | Tree name | Position | Tree height | Trunk diameter | Crown length | Crown width |
|----|-----------|----------|-------------|----------------|--------------|-------------|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
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| 6 | | | | | | |
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| 14 | | | | | | |
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| 16 | | | | | | |
| 17 | | | | | | |
| 18 | | | | | | |
| 19 | | | | | | |
| 20 | | | | | | |

| | Woodland 1 | Woodland 2 |
|-----------------------------------|------------|------------|
| No. of species | | |
| Average height | | |
| Average trunk diameter | | |
| Average crown length | | |
| Average crown width | | |
| Name of the most abundant species | | |

Shrub data

| Woodland 1 | | | | Woodland 2 | | | |
|------------|---------------|----------|--------|------------|---------------|----------|--------|
| | Name of shrub | Position | Height | | Name of shrub | Position | Height |
| 1 | | | | 1 | | | |
| 2 | | | | 2 | | | |
| 3 | | | | 3 | | | |
| 4 | | | | 4 | | | |
| 5 | | | | 5 | | | |
| 6 | | | | 6 | | | |
| 7 | | | | 7 | | | |
| 8 | | | | 8 | | | |
| 9 | | | | 9 | | | |
| 10 | | | | 10 | | | |
| 11 | | | | 11 | | | |
| 12 | | | | 12 | | | |
| 13 | | | | 13 | | | |
| 14 | | | | 14 | | | |
| 15 | | | | 15 | | | |
| 16 | | | | 16 | | | |
| 17 | | | | 17 | | | |
| 18 | | | | 18 | | | |
| 19 | | | | 19 | | | |
| 20 | | | | 20 | | | |
| 21 | | | | 21 | | | |
| 22 | | | | 22 | | | |
| 23 | | | | 23 | | | |
| 24 | | | | 24 | | | |
| 25 | | | | 25 | | | |
| 26 | | | | 26 | | | |
| 27 | | | | 27 | | | |
| 28 | | | | 28 | | | |
| 29 | | | | 29 | | | |
| 30 | | | | 30 | | | |

| | Woodland 1 | Woodland 2 |
|-----------------------------------|------------|------------|
| Total no. of individuals | | |
| Total no. of species | | |
| Average height | | |
| Name of the most abundant species | | |

Other plants data

| | Woodland 1 | | Woodland 2 | |
|---------------------|----------------|-------------------|----------------|-------------------|
| | No. of species | Brief description | No. of species | Brief description |
| Herbs | | | | |
| Grasses and sedges | | | | |
| Ferns | | | | |
| Mosses & liverworts | | | | |
| Fungi | | | | |
| Algae | | | | |

Animals

| | Animal name | Woodland 1 | | | Woodland 2 | | |
|----|-------------|------------|---------------|-------------------|------------|---------------|-------------------|
| | | No. | Micro-habitat | Functional niches | No. | Micro-habitat | Functional niches |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
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| 10 | | | | | | | |
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| 12 | | | | | | | |
| 13 | | | | | | | |
| 14 | | | | | | | |
| 15 | | | | | | | |
| 16 | | | | | | | |
| 17 | | | | | | | |
| 18 | | | | | | | |
| 19 | | | | | | | |
| 20 | | | | | | | |

| | Woodland 1 | Woodland 2 |
|-----------------------|------------|------------|
| No. of animal species | | |
| No. of individuals | | |

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Questions for discussion

1. Use the gradient data and plant data to draw a profile diagram. The diagram should be able to show the positions and relative sizes of the plants including trees, shrubs and climbing plants.
2. Compare physical factors of the two woodlands, what are the differences? What are possible causes of the differences? How do plants affect physical factors of the woodlands?
3. Compare the plants in the two woodlands, what are the differences? What are possible causes of the differences? How do trees affect diversity of other smaller plants - shrubs, ferns, epiphytes, herbs, etc.?
4. Compare the animals in the two woodlands, what are the differences? What are possible causes of the differences? Are they related to the distribution and diversity of plants?
5. Propose food webs for the two woodlands.
6. From a biologist's point of view, which woodland do you think is better? Why?
7. Describe any competitive, predatory and symbiotic relation.
8. Describe the adaptive features shown by the plants and animals. For examples, how do smaller plants adapted to low light intensity environment? How do small animals avoid numerous predators?
9. In what ways are human impacts important to the two woodland ecosystems in respect of their vegetative compositions and patterns, and their future development?
10. State the limitations of this field study and suggest how to improve it providing that there is no time constraint.
11. What further investigation(s) would you propose concerning woodlands in Hong Kong?

Study of Woodland Ecosystem

Field work equipment

| | | |
|----|----------------------------------|---------|
| 1 | Transect line | 1 pc |
| 2 | 3.5 m measuring tape | 1 pc |
| 3 | Light meter | 1 pc |
| 4 | Digital thermo hygrometer | 1 pc |
| 5 | Abney level and supporting frame | 1 set |
| 6 | Trowel | 1 pc |
| 7 | Plastic bag | 2 pcs |
| 8a | Forcep - blunt | 2 pcs |
| 8b | Forcep- fine | 2 pcs |
| 9a | Vial - large | 4 pcs |
| 9b | Vial - medium | 5 pcs |
| 9c | Vial - small | 5 pcs |
| 10 | Magnifying glass | 2 pcs |
| 11 | Air net | 1 pc |
| 12 | Compass | 1 pc |
| 13 | Sorting tray (white) | 1 pc |
| 14 | Pooter | 1 pc |
| 15 | Cotton gloves | 2 pairs |
| 17 | Counter | 1 pc |
| 18 | Quadrat - 50 x 50 cm | 1 pc |
| 19 | Map | 1 pc |
| 20 | Ruler - 30 cm | 1 pc |
| 21 | 30 m measuring tape | 1 pc |
| 22 | Anemometer | 1 pc |

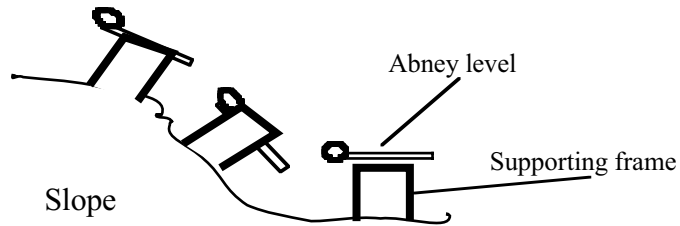
References

| | |
|----|-------------------------------|
| 1 | Hong Kong Animals |
| 2 | Hong Kong Insects |
| 3 | Hong Kong Insects Vol. 2 |
| 4 | Hong Kong Trees |
| 5 | Hong Kong Shrubs vol. 2 |
| 6 | Hong Kong Herbs vol. 2 |
| 7 | Grasses & Sedges of Hong Kong |
| 8 | Hong Kong Ferns |
| 9 | Hong Kong Climbing Plants |
| 10 | Plants in Chuen Lung Woodland |
| 11 | woodland animals |

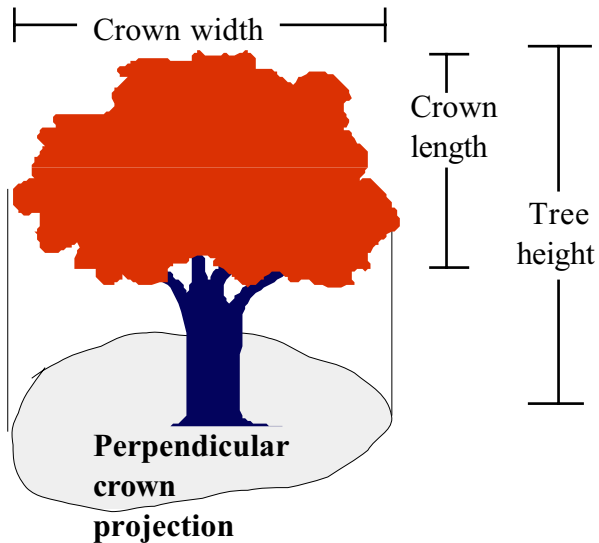


Appendices

Appendix 1 : Measuring gradient

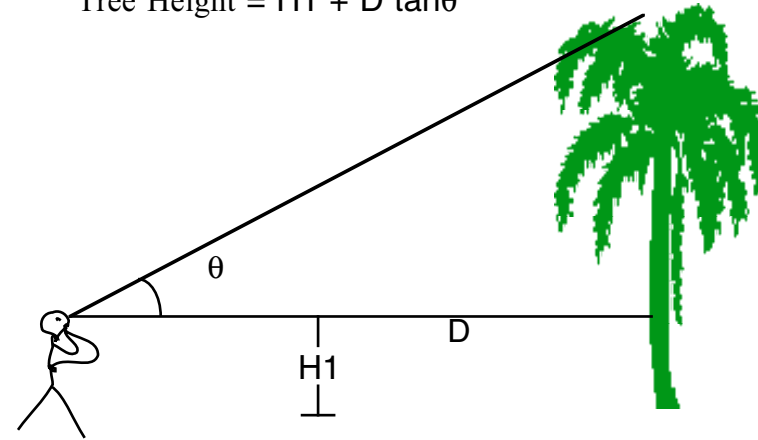


Appendix 2 : Describing trees



Appendix 3 : Measuring tree height

$$\text{Tree Height} = H1 + D \tan\theta$$



Appendix 4 : Example of profile diagram

