**MODULE 5: FIELD TECHNIQUES**
**Practicum 1: Making Observations**

Visit a nearby forest. If possible, visit stands representing a variety of disturbance or management histories (e.g., natural, old-growth; selectively managed; early even-aged). Allow students sufficient time to observe each forest, and to record their observations in a field journal or a notebook from which to base a naturalist essay.

Guide students to observe the structural characteristics of the forest and to consider the relationships between structural heterogeneity and biodiversity. Prompt their observations with questions like those that follow.

FOREST CANOPY LAYERING AND GAP CREATION

What are the species and sizes of trees in the forest? How are they spaced (evenly, randomly, clumped)? Does the forest appear to have layers? What is forming the layers? How many layers are discernible? Describe the light levels from the canopy to the ground.

Are there open areas in the forest canopy? What happened to cause the opening in the canopy? Is there more sunlight in the opening? What other differences can you see in the area beneath the opening in comparison with the areas beneath closed canopy?

Describe the herbaceous plants around you. Do the herbs form a continuous layer or are they sparse? Are there flowers or fruits? Do different species occur in well lit canopy gaps? On or near logs? In disturbed mineral soil?

LARGE TREES

Look for big trees. How many sets of outstretched arms would it take to fit around the largest tree you see? Describe or sketch its shape, especially with regard to its crown and primary branches. Are the branches straight or contorted? Is there evidence of past breakage? Is the bark intact? Look for recently fallen branches. Try to find branches of different sizes and compare the amounts and types of mosses and lichens growing on them. Are these epiphytic organisms distributed equally around the branches?

If there is any loose bark, peel it back and investigate the organisms living under it. Likewise, observe the mosses and lichens living on the bark. Do different species seem to occur at different heights above the ground? Do some species live within the bark fissures while other live on the bark ridges? With the aid of a microscope or magnifying glass explore the organisms living within the mats of mosses and lichens.

Scan the outside of the tree, especially toward its crown. Do you see any apparent cavity openings? Estimate the size of the openings.

FOREST FLOOR AND SOILS

Describe the forest floor. What components make up the forest floor? Are the components to your left the same as those to your right? Describe the topography. Is the floor flat or sloping? Are there mounds? What are the mounds formed from? Are there plants on the mounds? Are the same plants on the mounds found on the ground too? Grab a handful of soil and describe it.

Walk 10 paces and grab another handful of soil. Is it different or the same as the one you held before?

SNAGS

Are any of the standing trees actually dead? Describe the appearance of or sketch a few snags (dead trees). How do they differ? Can you estimate the height of the tallest snag around you? Do these snags occur in clusters or are they scattered individuals? Are there any cavities? Describe any signs of wildlife activity in the snags.

LOGS

Observe several decaying logs. Are any hollow? How far can you push your pen or a knife into each log? Are any of the logs so well decayed that you can crumble them in your hands? Use characteristics such as presence of bark, and hardness/softness of wood to describe 3-4 stages of wood decay. Look for fungi, slime molds, invertebrates, lichens and bryophytes. Carefully role some logs over to observe what is living beneath. Do any plant roots penetrate the logs? Do different organisms occupy logs of different decay stages?

WILDLIFE

Observe any wildlife or signs of wildlife. Pause for a bit and listen…what do you hear? Document any wildlife activities you observe: are they eating, perching, hiding, flying overhead? Where are they—on the ground, on a branch, under a log or on a rock?

## Practicum 2: Learning the Scientific Method

### Summary

The goal of the scientific method is to discover cause and effect relationships by asking questions, carefully gathering and examining the evidence, and seeing if all the available information can be explained. Understanding the steps of the scientific method will help you focus your scientific question and work through your observations and data to answer the question as well as possible. This practicum focuses on learning how to make observations and formulate hypotheses.

### The Process: Steps of the Scientific Method

1. *Ask a Question*

The scientific method starts when you ask a question about something that you observe: How, What, When, Which, Why, or Where?

2. *Construct a Hypothesis*

A hypothesis is an educated guess about how things work. It is an attempt to answer your question with an explanation that can be tested. A good hypothesis allows you to then make a prediction: "If the hypothesis is true, then_____."

**In-Class Exercise**

In small groups, take a walk in the arboretum and make a list of ecological observations.

Next, compile some questions about your observations, e.g., “What kind of food does this bird eat?” or “How is this flower fertilized?”

Using these questions, you can begin to formulate some hypotheses, e.g., “This bird eats the fruit of the X Tree” and “This flower is fertilized by X Insect”.

This is the beginning of the process of designing an experiment in which you can test a hypothesis.

## Practicum 3: Collecting Data

Summary
This practicum focuses on learning how to collect and compile field data.

In-Class Exercise

In small groups, class members will collect several sets of data using the FTI campus as a “field site”. Student groups should choose what kind of data they will collect, e.g., height of grass, DBH of trees, birds species observed.

These data can be used to think through survey design and to conduct basic statistical exercises.

## Practicum 4: Refer to excel sheets for Statistics practicums 1-5

## Practicum 5: Reviewing Scientific Writing

### PREPARING A REVIEW

This exercise focuses on learning to review scientific writing. Below is a framework to help guide you in a review of scientific literature. So, what should you look for when reading a paper? The following list of questions can help you critically read and evaluate scientific writing.

## 1. What is the main question(s) the author(s) is exploring?

Summarize the main questions of the paper.

## 2. What are the methods the authors used to test the question(s)?

Study the methods closely. Often, flawed methods are at the heart of a poor paper. Examine the assumptions that the methods suggest. Do the authors clearly state and test hypotheses, or use strong, comparative approaches? What is the sample size? Is it large enough? Is it reliable and representative of the target population? Was it randomly chosen? If an author uses interviews, how did they check for accuracy? Whom did they interview and how were the interviewees chosen? Were the questions biased in any way? If they are looking at ecological processes, over what time frame and at what spatial scale, did the study take place? Do the methods sufficiently describe the work such that you could imagine repeating it? If not, what do you think is missing and why? Answering these questions is key to understanding the rest of the paper.

## 3. What are the principal results?

Did the authors clearly show their findings and the data used to generate them?

## 4. How strong is the evidence?

Looking at the results, are you convinced by their analysis? Do the authors make a strong case? Ensure that you are convinced by their arguments and the quality of the data and analysis presented.

## 5. Are the statistics deceptive?

Are the authors using the right statistical analyses for their data? Poor statistical analyses are all too common, and can undermine even well designed and well-argued papers.

## 6. What conclusions do the authors draw?

Is the analysis the most viable interpretation of the results? Are there other ways of interpreting the evidence? What reasonable alternative conclusions are possible but not mentioned? Can the authors truly distinguish causation from correlation? Do the authors make over-reaching generalizations that are unsupported by the evidence?

## ACTION: PREPARING A REVIEW

In-Class Exercise: Each group can provide a two-sentence summary of a section of an article and write a summary. Missed information can be highlighted as a learning exercise.

Take home assignment: Working in small groups, use your notes in response to the questions above