Terrestrial and Aquatic Field Study

Curriculum Connection

- *Biology 20, Unit A: Energy and Matter Exchange in the Biosphere (2006 Implementation)*
    - *20–B1.2k, 20–B1.3k, 20–B1.2s, 20–B1.3s, 20–B1.4s*
- *Science 20, Unit B: Changes in Living Systems (2006 Implementation)*
    - *20–D1.1k, 20–D1.2s*

Objectives

Students will:

- *explore and identify biotic and abiotic components of terrestrial and/or aquatic ecosystems.*
- *understand the relationship between these biotic and abiotic components as well as their affect on populations.*
- *develop skills that facilitate group work and data collection in the field study.*

Lesson/Activity Duration

- One class period to prepare.
- ½ day for terrestrial or aquatic study
- Full day to complete both the terrestrial and aquatic field study

Materials Needed

Part A- Terrestrial Field Study

Each group should have access to the following:

- Guide books- plant, animals, insects
- Flagging tape
- Measuring tape (at least 10m)
- Ruler
- Thermometer
- Trowel and/or soil sampler
- Soil Texture Chart
- pH meter or litmus paper, water, and 25ml plastic test tubes
- Compass (optional)

Part B- Aquatic Field Study

- pH paper
- Aquatic invertebrate guides
- Bucket
- Ice cube trays, baster, and brush for isolating invertebrates
- Dissolved Oxygen Test Kit (with instructions)
- Phosphate Test Kit (with instructions)
- Nitrate Test Kit (with instructions)
- Waste chemical containers
- Secchi disk, turbidity chart
- Armoured Thermometer

- String

** Many of these materials are available through:*
Boreal/Northwest Scientific Supply Ltd.
Phone toll free: 1-800-387-9393
Or visit www.boreal.com

** Plant and animal ID Guide Suggestions*

- *Guide to the Common Trees and Shrubs of Alberta,* available from Inside Education- www.insideeducation.ca, 780-421-1497
- *Plants of the Western Boreal Forest & Aspen parkland, Plants of the Rocky Mountains, Mammals of Alberta, Birds of Alberta, Butterflies of Alberta,* all available from Lone Pine Publishing at most bookstores, some grocery stores and some gas stations
- *Handbook of the Canadian Rockies, Ben Gadd*
- *Animal Tracks of Western Canada, Joanne E. Barwise*
- *Aquatic Invertebrate Monitoring (AIM) Program*, *Identification Key to River Invertebrates,* available from Inside Education, www.insideeducation.ca 780-421-1497

Background Information
Terrestrial and aquatic field studies have long been a part of high school science programs and allow students to explore and identify the relationship between biotic and abiotic factors. Science 20 classes can choose to perform either the Terrestrial study (A) or the Aquatic study (B). Biology 20 classes will perform both components.

Extension questions can take data further and promote discussion and critical thinking.

Important Vocabulary
Have students become familiar to student worksheets prior to study, addressing any difficult or new vocabulary.

Procedure

- Review field trip procedures, rules, and expectations in class prior to field study.
- Pick suitable field site that offers easy, and safe access to forest and aquatic test sites.
- Review procedures for all measurements and ensure kits and materials are complete, intact, and functioning.
- Break class into groups of 4-6, and reinforce the importance of sharing roles, and information. Each student will have a copy of the worksheets to fill out during program.
- Having ID Guides for each group is also ideal, however, it is possible for a couple of guides to *float* from group to group.

**For more information on Alberta-Pacific's terrestrial / aquatic research programs, click here.*

Extension
Using the data collected by the students in the two different field study areas, here are several possible follow-up extension activities:

1. Draw a chart in your journal with the following columns: Abiotic, Biotic, Neither.
    a. Using your plot study sheets, assign each measurement collected to the associated column heading.
    b. Which abiotic factor(s) have had the greatest effect on what you see in your field site? Why?

2. Draw a chart in your journal with the following columns:

Species Category	# of Organisms Counted/Collected	Divided by the total sightings	Multiply by 100	% Composition
Producer				
Consumer				
Decomposer				
Total				

    a. Fill out your chart using the data from your field sheets
    b. Using the percent composition calculated for each species category above, draw a pie chart representing the relative composition of each category.
    c. Do you think that one species category is over- or under-represented because of the way the data was collected? Why or why not?

3. What effect would a change in the following have on your results:
    a. Season
    b. Precipitation
    c. Disturbance such as forest fire or flooding
    d. Human development

4. In analyzing your scientific method, list at least two concerns you have about the accuracy of your measurements. Be as specific or as general as you want to be.

Part A - Terrestrial Field Study Report

NAME: _____
Date: ____ / ____ / ____ Time _____: _____ am/pm Location: _____
d m yr

1. General Site Description
Describe your site by placing a checkmark beside the correct category.

Weather Conditions	**Wind Speed**	**Proximity to Water**	**Evidence of Disease**	**Evidence of Fire on Trees (burnt debris)**
❒ Clear Sky ❒ Partial Cloud ❒ Overcast ❒ Precipitation	❒ >40 km/h (trees sway) ❒ 21-40 km/h (branches move) ❒ 1-20 km/h (leaves rustle) ❒ <1 km/h (smoke rises up)	❒ Near running water ❒ Near pond or lake ❒ Near slough, bog ❒ No water	❒ Extensive (>20 affected) ❒ Some (10-20 affected) ❒ Limited (<10 affected) ❒ None	❒ Numerous debris (>20 pieces) ❒ Some debris (10-20 pieces) ❒ Limited debris (<10 trees) ❒ No evidence

2. Evidence of Wildlife Activity
List the type of animal evidence found at the following levels (i.e. tracks, hair, scat/droppings, rubbings, chewed/grazed plants) and record the number observed. Be specific - e.g. Moose tracks, deer scat, actual squirrel

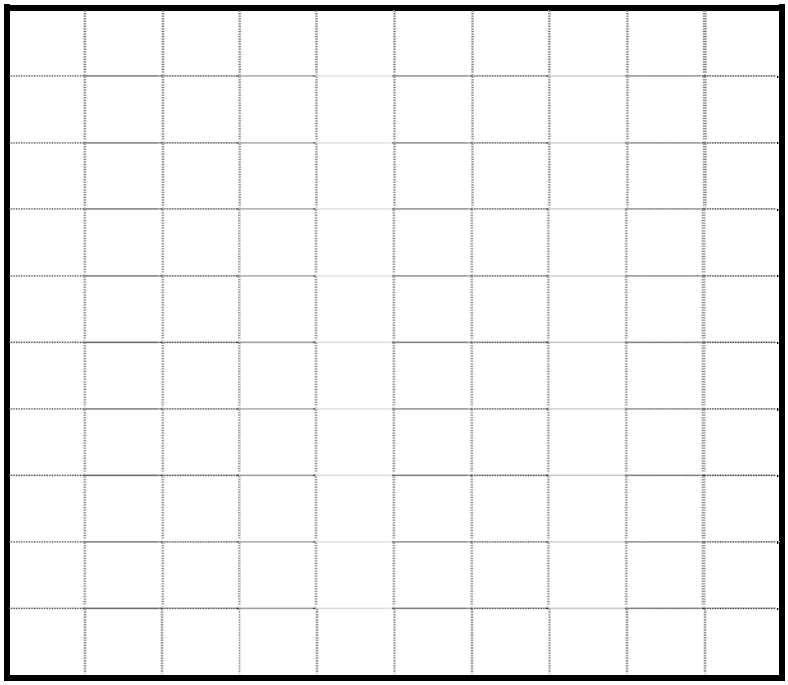
Canopy Layer	Sub-Canopy	Forest Floor	Soil (Underground)

Measure a 10m by 10m quadrat using a measuring tape, marking each corner so you can see the boundaries.

3. Plot Study Diagram, and Vegetation Identification

In the grid below, draw an aerial view of your plot. Include all plant, animal, human, and non-living evidence you observe. Complete the legend below including identifying specific plants. (e.g. white spruce Picea glauca)

North ↑



Legend	Type	% Cover
e.g. M = Moss		
_____ =		
_____ =		
_____ =		
_____ =		
_____ =		
_____ =		

4. Measuring Trees

Select a minimum of one average-sized tree in your plot and complete the following chart. ** See appendix for measurement instructions.*

	Tree # 1	Tree # 2
Species		
Diameter-DBH (cm)		
Height		

5. Temperature

For each temperature reading leave thermometer in place for at least 2 minutes.

Thermometer Temperature

1 m above ground- _____.

At ground level- _____.

10 cm below ground- _____.

6. Soil

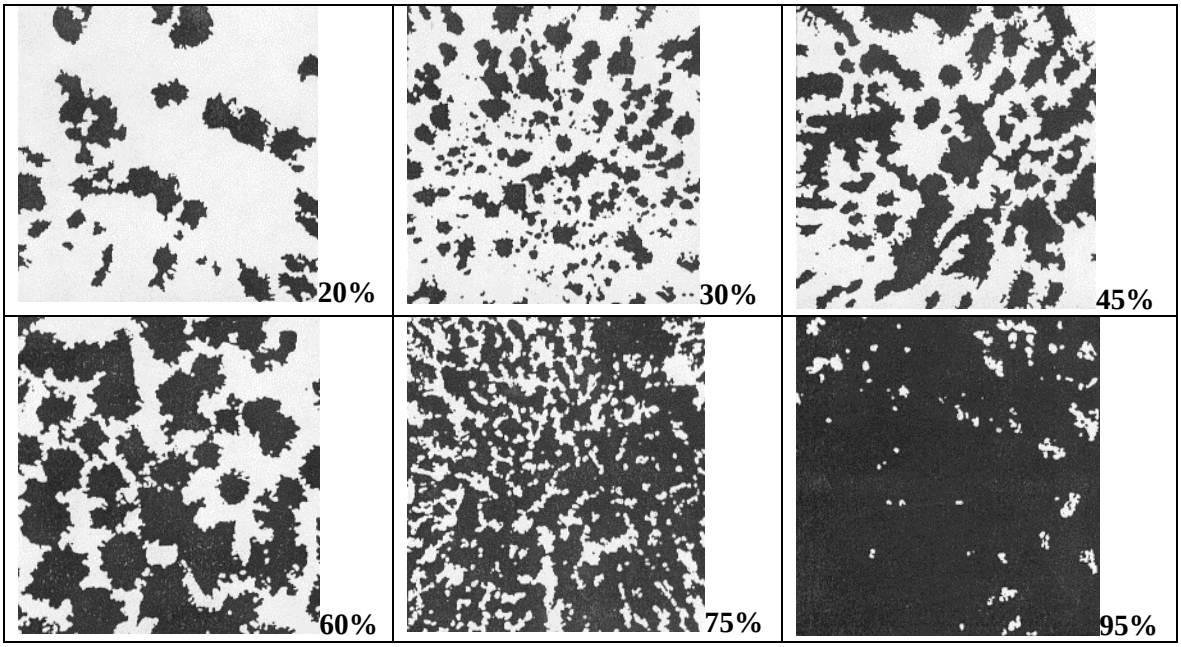
Using a soil sampler, or trowel, take a sample of the soil in your plot. Draw your sample, marking the depth of each layer beside your drawing, and use the soil chart to determine the texture of each soil layer. Record the pH of each soil layer using the pH meter or litmus paper.

Layers (sketch)	Depth from Surface	Soil Texture	pH

7. Canopy Cover

Pick 4 different locations in your plot. At each location, look up toward the canopy trees. Visually estimate what percent of the sunlight is blocked by the canopy tree leaves and branches using the pictures below as a reference. This is the % canopy cover.

Measurement Location	Canopy Cover (%)
Average	



Part B - Aquatic Field Study Report

NAME: _____

Date: ____ / ____ / ____ Time _____: _____ am/pm Location: _____
d m yr

1. Physical Characteristics:

What type of water body is this? (e.g. river, stream, lake, wetland)

_____

Substrate:
What is the composition of the bed? (check ✓)

☐ Sand/Silt (less than 2mm)

☐ Gravel (0.2-6.5 cm)

☐ Cobbles (6.5cm-25cm)

☐ Boulders (greater than 25cm in diameter)

* *If substrate is more than one of the above, estimate the percent composition of each.*

Human Impacts
Is there any evidence of human impacts in the area? Record them below.

Type of evidence e.g. garbage, dock	**Location** e.g. in water, on shoreline, more than 5 meters from shoreline

Would you say the riparian area is healthy? Why or why not?

2. Biological Characteristics:

* using an aquatic plant guide, identify at least one of each of the following plants

Plant type	**Identify vegetation** (include common and scientific name)
Submergent Plant	
Emergent Plant	
Floating Plant	
Land Plant	

*Using the key provided, and dipping equipment, isolate, draw, and identify 4 different aquatic invertebrates.

Name of Invertebrate (including Order)	**Drawing of Invertebrate**	**Quantity Found**

3. Chemical Characteristics:

Test	Result
Phosphate (mg/L) *(follow test kit instructions carefully)*	
Nitrate (mg/L) *(follow test kit instructions carefully)*	
Turbidity *Lower sechhi disk into water* *Record depth at which disk is no longer visible.* *Repeat 3 times.* **Each measurement should be performed by a different person. Why do you think this is important?*	
pH	
Dissolved Oxygen (mg/L)	
Temperature (^{0}C) *(be careful when lowering thermometer so not to damage or break)*	_____ ^{0}C at surface _____ ^{0}C at halfway point _____ ^{0}C near bottom
Water Hardness *(follow test kit instructions carefully)*	

Appendix

Measuring Tree Height

Using a ruler, two students, and the following procedure:

Have one person ("Jane") stand at the base of the tree.

Measure Jane's height in metres.

A second person walks backwards, arm outstretched, both eyes open and holding the ruler, until the ruler exactly 'covers' the tree. Then, keeping the ruler steady, this person will measure and record the height Jane reaches on the ruler.

Find out the number of Janes the tree is by dividing the height of the tree, 30 cm in the ruler, by the height Jane comes to on the ruler. This determines the ratio of Jane to the tree.

Multiply this ratio by Jane's measured height to determine the tree height.

For example:

> If Jane reaches 2cm on the ruler, the number of Janes it would take to reach the top of the tree is 30cm ÷ 2cm = 15.
>
> If Jane's measured height is 1.2m, the height of the tree is 1.2m x 15 = 18m.

Once several different sized trees have been measured, use your own visual judgment on the relative sizes of other trees nearby.

Measuring Tree Diameter

Using a regular measuring tape, measure circumference approximately 1.3m off the ground by wrapping the tape measure around the tree. Diameter can then be determined using a calculator and the formula:

$d = C \div \pi$ (diameter = circumference / pi)
e.g. d = 72.22cm ÷ 3.14 = 23cm

Using a ruler, diameter can be roughly estimated by holding the ruler up to the tree and measuring from widest point to widest point on the tree.