



SCHOOLYARD LICHEN SURVEY

Subject Area: Science

Activity time: 60 minutes

Setting: Schoolyard and classroom with computer connection

Skills: Analyzing, Applying, Categorizing, Collecting information, Comparing, Contrasting, Discussing, Hypothesizing, Inferring, Measuring, Summarizing

Vocabulary:

- **Biological Inventory:** A technique used by scientists to make a count of a particular species or ecosystem at one point in time.
- **Biological Monitoring:** A technique used by scientists to check the condition of a particular species or ecosystem over time. Monitoring usually consists of comparing inventories with one another to establish trends.
- **Crustose:** crust-like lichen growth form with the lower surface growing on and among the particles of its substrate (rocks, bark...). Crustose lichen cannot be removed from the substrate in one piece.
- **Foliose:** leaf-like lichen-growth form with a flattened body and distinguished upper and lower surfaces.

- **Fruticose** – shrubby or hair-like lichen growth form with no distinguishable upper and lower surface. Fruticose lichen either stands erect or hangs down from its substrate.
- **Lichen:** A lichen is a mini-ecosystem consisting of at least two organisms: a fungus and a photosynthetic partner (algae or cyanobacteria).
- **Symbiosis** – the living together of unlike organisms; it may be for mutual benefit or not.

Materials:

For each group:

- Pencil
- Wet erase marker
- Compass
- String
- Scissors to cut the string
- Tree identification book (optional: see extension activity #1)
- Lichen Growth Forms sheet (page 3)
- Lichen Grid transparency (page 4)
- Lichen Biomonitoring Datasheet (page 5)
- Measuring tape
- Four clothespins
- Data sheet
- Clipboard
- Magnifying lens

Objectives:

- 1) practice identifying lichen growth forms by their physical characteristics
- 2) gather baseline data by determining the percent of lichen coverage on tree species found in the schoolyard

- 3) determine if there is any change in lichen coverage over time (long-term)
- 4) attempt to correlate any changes in lichen coverage to environmental factors such as air quality/atmospheric pollution (sulfur dioxide, ground level ozone, acid rain)

Background:

This activity replicates the activity that is completed by students in the Smokies but can be done in your own schoolyard. For this activity it will be important to focus on the differences between one lichen growth form and another. Use the “Lichen Growth Forms” worksheet (page 3) to help in identifying. Copy the Lichen Grid (page 4) onto transparencies. Copy front and back the Lichen Data sheet (page 5).

Select trees for your students to study, we prefer to have students in groups of 4 or less. For comparison, you can select trees species that are all different or are all of the same. In general, it is better to select trees with less acidic bark (ash, elm, sycamore) but if that isn't possible then oak, beech, birch will do. Try to avoid trees with highly acidic bark such as Hemlocks as they are less likely to be able to naturally support lichen populations. Measure 4 ½ feet up from the ground (DBH height = diameter at breast height). Measure 5 ½ inches up from this point and tie a string around the tree. Measure 5 ½ inches down from this point and tie a string around each tree. The students will be attaching their grid transparencies to this string using clothes pins. Label the tree with species name and tree number (you can have the students do this as an





extension activity).

Procedure:

(Steps 1-3 can be done in a separate class period if necessary)

1. Students will need to know how to find the cardinal directions (North, South, East, West) using a compass. This step is important if you are setting up a long-term monitoring study. If you need instructions, please go to the website : <http://www.learn-orienteing.org/old/lesson1.html>
2. Show students how to classify lichens into their three morphological groups, ID moss and bare bark.
3. Show students how to read the data sheet, also have them fill out important information before going to their study tree (such as today's date, group name, location).
4. Explain to students which side of the tree you would like them to begin collecting (north, south, east, west). Remind them to use their compass to find that side.
5. Have students attach their transparency grid to the appropriate side of the tree using the clothes pins.
6. Have students measure and record the tree's circumference at the middle of their attached transparency (4 ½ feet up from the ground).
7. Have students estimate and record the canopy cover when standing underneath their study tree.
8. Have students classify the lichen type found under each of the circle in square 1. Record this on the datasheet in the square labeled "1". They should have 10 marks in each square since all circles can be classified into one of the categories (crustose, fruticose, foliose, bare bark, moss).
9. Repeat the previous step for all 9 boxes.
10. Follow the instructions on the

datasheet to calculate the total lichen coverage for that side of the tree. [Count total number of marks for each lichen type, bare bark, and moss. Divide the number for each lichen type, bare bark, and moss by 90 to get a decimal. Multiply these decimals by 100 to get the percentage of lichen coverage.]

11. If time allows, do another side of the tree or the next class period can complete another side of the tree.

Quality Assurance: To ensure that data are accurate, you can have more than one group survey each tree. If the data match, it can be accepted, if not, the tree will need to be reassessed.

Extension activity #1: Have your students ID and record the tree species they are studying or you can do that for them.

Extension activity #2: Have your students measure the pH of the bark of their tree. Remove small piece of bark, soak it 24 hours in distilled water (pH 7) and then test it with a pH strip or meter.

Wrap Up:

Regroup the students and review the data collected. If you had different species of trees, was there any difference in lichen coverage? Why might there be a difference? (pH of the bark is one probable explanation) Is one lichen growth form more common than the others? Which one? The most sensitive types of lichens tend to be the ones that protrude the furthest from the tree.

In the Great Smoky Mountains National Park, we are checking to see if we are losing more sensitive

types of lichens (a foliose group called Lung lichens or Lobaria) and looking to see if they are being replaced by lichens more tolerant to acidic environments (typically crustose lichens since they have less of a surface area to volume ratio).

Data Analysis: Students can create pie or bar graphs of the classification of coverage by tree species and/or tree species by lichen composition. Ideally, this data should be saved each year so students can compare their data with previous year(s). If this is being done, is there any change over time? This can be illustrated with a line graph showing percent coverage by lichen type and tree species.

Reference Books

- *Lichens of North America*. Irwin Brodo, Sylvia Duran Sharnoff and Stephen Sharnoff.
- *Lichens*. William Purvis



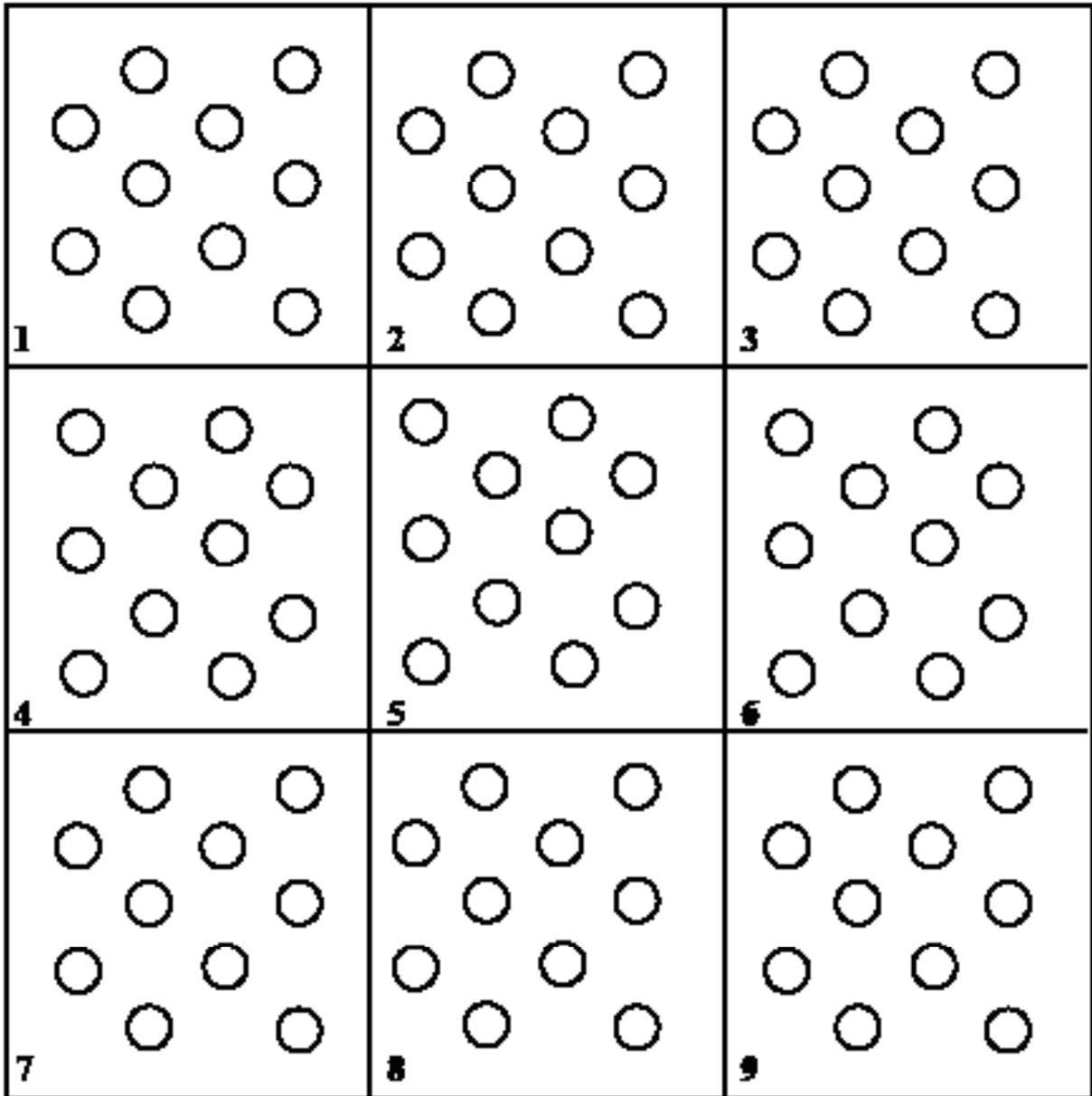
Lichen Growth Forms

(overall shape and configuration of the lichen body)

- **FOLIOSE (leaf-like)**
 - flattened body
 - distinguished upper and lower surfaces
- **FRUTICOSE (shrubby or hair-like)**
 - grow erect or hang straight down
 - no distinguishable upper and lower surfaces
- **CRUSTOSE (crust-like)**
 - lower surface grows on and among the particles of the substrate
 - cannot be removed from the substrate in one piece



Great Smoky Mountains National Park





Lichen Monitoring Datasheet

Group Name/School: _____ Tree Species (and ID #): _____

Date: _____ Tree Circumference: _____ cm

Location: _____ Canopy Cover: 0-20%, 21-40%, 41-60%, 61-80%, 81-100%

Directions: Pick a side of the tree (due North, South, East, West) and attach the transparency grid to the tree using the clothes pins. Record what you see under each circle in each of the nine boxes. Each box should contain exactly 10 marks. If you see more than one thing in any circle, mark the one that makes up the majority.

Direction (North, South, East, West): _____

Crustose _____ Foliose _____ Fruticose _____ Moss _____ Bare Bark _____ #1	Crustose _____ Foliose _____ Fruticose _____ Moss _____ Bare Bark _____ #2	Crustose _____ Foliose _____ Fruticose _____ Moss _____ Bare Bark _____ #3
Crustose _____ Foliose _____ Fruticose _____ Moss _____ Bare Bark _____ #4	Crustose _____ Foliose _____ Fruticose _____ Moss _____ Bare Bark _____ #5	Crustose _____ Foliose _____ Fruticose _____ Moss _____ Bare Bark _____ #6
Crustose _____ Foliose _____ Fruticose _____ Moss _____ Bare Bark _____ #7	Crustose _____ Foliose _____ Fruticose _____ Moss _____ Bare Bark _____ #8	Crustose _____ Foliose _____ Fruticose _____ Moss _____ Bare Bark _____ #9

	total # with this substrate	divide number in last box by 90 (you'll get a decimal)	multiply this by 100 to get the % of this substrate
Crustose			
Foliose			
Fruticose			
Moss			
Bare Bark			

