

4. CREATING A SCIENTIFIC COLLECTION

Target audience

9th grade and up

Subject

Create a lichen herbarium and database.

Objective

Students will

1. Make herbarium packets to store lichens and curate each lichen sample on stiff paper backing and cotton padding.
2. Enter lichen sample and collection site data into spreadsheet or database.
3. Make labels for packets.

Time Needed

Two to three hours teacher preparation time

One to five classroom hours, depending on the number of collections and students.

Materials

1. One computer per group of students.
2. A spreadsheet program (e.g. Microsoft Excel) or relational database program (e.g. Access) on each computer.
3. Printer paper (8"x11") for making lichen packets, 1 sheet per lichen sample. *Acid free* or *100% cotton paper* is necessary for permanent collections and can be ordered from a herbarium supply company.
4. 3"x5" unlined index cards, one per lichen sample. Use *acid free* or *100% cotton paper* if long term storage is desired; herbarium mounting paper can be purchased from a herbarium supply company and cut to card size.
5. 2" wide rolls of medical cotton batting, one roll for every 40-50 lichen samples.
6. Printer paper cardboard boxes, one box for every 100-200 lichen samples. (These boxes are the ones that hold several reams of 8"x11" printer paper. Also obtain the lids if possible for ease of stacking boxes. For reference, the dimensions of these boxes are approximately 12"x16" by about 10" deep. They should fit inside a standard herbarium cabinet.) For smaller collections, shoe boxes can be used.

Activity

Folding Packets

Each packet is made of one 8"x11" sheet of paper, folded four times. Begin by placing the sheet of paper on a table with one of the 8" sides of the sheet facing you.

Fold 1 Make one fold by taking the 8" side of the sheet closest to you and fold it away from you just shy of one third of the width of the sheet. This is like folding mailings into thirds to put to fit it in a regular large letter envelope, except only make the first fold.

Fold 2 & 3 Now, fold the two long sides of the sheet about 1.5" toward the center to make two side flaps, on either side of the pocket created by your first fold.

Fold 4 Take the only remaining unfolded side, the one furthest from you, and bring fold it toward you to make it flush with the side closest to you.

If you get comfortable doing this, you can fold 4-6 sheets simultaneously on the first fold to save time.

Cutting Batting

Cut 2"x 2" sections of cotton batting, one for each packet. There is no need to be fastidious about the specific size because any size that will fit on the card will work and gauze rolls can be different widths. Take the 3"x5" card and insert one in each envelope along with one piece of batting. This will give the lichen a soft place to rest in the envelope reducing crushing of the sample. If you like a neat look, consider lightly gluing the batting to the card with white school glue or mucilage. Archival quality glues can be purchased at a herbarium supply store if desired.

Putting Lichens in Packet and Numbering Packets

For this part of the activity, utilize the lichens collected from lesson plan "Collecting Lichens" that were dried and put in numbered paper bags. Start with one bag and take one lichen sample and put it on the cotton padding in the prepared envelope. Because one usually needs to see all sides of a lichen to identify it, don't glue the lichen to the padding or card. Afterward, label the envelope with the number of the bag. Be careful to place each species in its own packet and transfer the number from the bag right away. Proceed like this until all the lichens are in envelopes with numbers corresponding to their original bag and keep the packets separated into groups of the same number.

Some notes on packaging difficult specimens

1. *Very small lichens.* A tiny second packet can be folded to hold the specimens inside the standard size packet.
2. *Lichens on large rocks.* If the rock is too big to fit in a package you can consider making it smaller. Wearing goggles and in a place where flying rock fragments will not cause damage, a flat sliver of rock (hopefully supporting the still intact specimen) can be chipped off using a hammer and cold chisel. Alternatively put the herbarium information on a piece of tape on the rock and store the rock in its own box. If the specimen is on more than one rock, it may be a good idea to glue the

rocks to the card so they don't rub against each other and damage the specimens.

3. *Bulky lichens*. For bulky, fragile lichens, Styrofoam mailing peanuts can be glued to the card on either side of the specimen to keep it from being crushed inside the packet. Alternatively, damp lichens from the field site can be placed in a regular plant press (or if already dry, then re-hydrated in distilled water before pressing) and allowed to dry 1-3 days. The pressure of the cover will be sufficient, tightening the straps will overly-flatten specimens. Also, always dry lichens at about room temperature; higher temperatures can degrade or volatilize lichen secondary chemicals that may be necessary later for a definitive identification.
4. *Very large lichens*. If a lichen is too big to fold inside a packet, it can be lightly pressed and minimally taped to a 11 X 17" herbarium mounting sheet, like a vascular plant. During the pressing make sure that the lichen is folded so that both upper and lower surfaces are visible. Mounting sheets would be stacked on a herbarium shelf like those of other vascular plants, with the labeled glued to the lower right hand corner.

Labeling the Packets

1. **Option 1** This option is simple but labor intensive and doesn't produce a "professional" looking packet. Simply label the packets by hand using a fine tipped pen with all the information you collected about the site and substrate in the little field notebooks (see sample packet). Arrange the information in a logical and readable manner on the packet while leaving space for the name of the lichen in the top left hand corner of the label. In addition, you must add a collection number to each packet. The collection number is specific to the collector, so the first packet contributed by each person to the herbarium would be the collector's first initial and last name followed by the number '1'. The next packet would be number '2', etc. If there are multiple collectors for a single specimen, include multiple names (X, Y & Z) followed by the next number belonging to the person listed first. Alternatively, or in addition, give accession numbers to the herbarium. So, if the herbarium contained 100 specimens, the accession numbers would be 1 to 100, independent of collector names.
2. **Option 2**. Most herbaria label packets with printed labels. A simple way to make labels is to create a template packet label using a text box in a word processing program (e.g. Microsoft Word). Include in the text boxes places for information about the lichen and the site at which it was collected. 3 packet labels will fit on one piece of 8"x11" printer paper. Once enough packets are printed for one substrate at one site, erase the substrate and type in the next substrate and print the necessary number of labels. Don't forget to change the collection number for each packet. Cut out and glue the labels to the matching packet. Once all the lichens are in labeled packets, they can be put into the printer paper boxes, standing upright in two rows. However, it is best to cut down the boxes to a height just higher

than the packets. When the lid is replaced, the boxes can be stacked. Most herbaria store lichens in alphabetical order by genus and species. For a monitoring study, you may wish to store them by site then genus and species.

Vocabulary

Lichen herbaria are very important because they store the information that science uses to further refine biological, physiological and ecological understanding of lichens. Scientists from around the world trade samples from herbaria to enable researchers to have large geographic range in the specimens they can observe. For example, if someone in Oslo, Norway, is writing a paper on all the *Ramalina* species of that occur in maritime ecosystems in the northern hemisphere, they don't have to necessarily go out and collect all of them. Instead, they can write herbaria and have samples sent to them. Fortunate for the Norwegian researcher, most people who add to herbaria record ecological and site information for each sample collected (as seen in the lesson plan "Collecting lichens"). The herbaria packets and database record this ecological and site information the collectors noted so that people like the lichenologist in Oslo can request lichens from specific areas, elevations, habitats, etc...

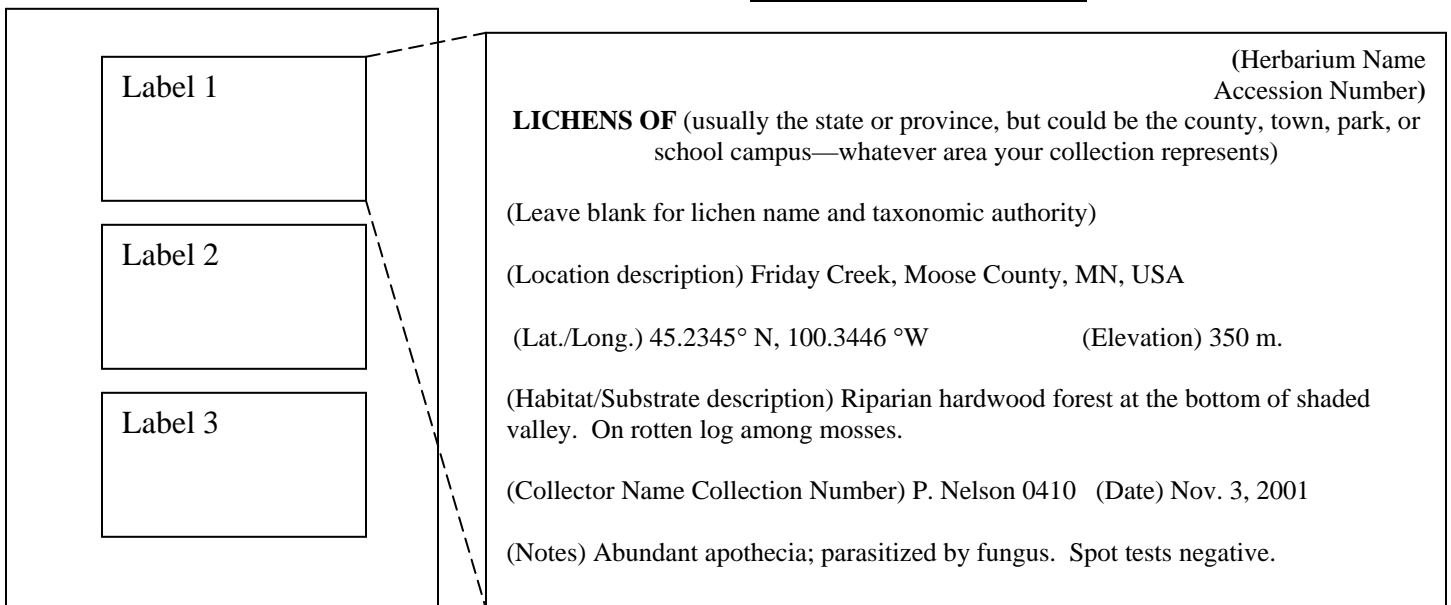
Lichen herbaria are made of essentially two parts; the database and the actual collections of lichens stored in an organized and stable environment. The database demonstrated here is a very simple version of how to store lichen information, using a Microsoft Excel spreadsheet in this case. Each column is a piece of information that should be collected for every lichen sample collected, which are the numbered rows in the spreadsheet. The actual physical lichen samples are stored in paper envelopes folded from standard 8"x11" printer paper, though it is best to use acid-free otherwise lichen sample's chemistry can be changed over time while the lichen sits in the packet. Each packet is then given a number and other information, as shown in the sample packet later in this document.

1. **Database:** a place to store information about lichen collections, usually in a computer program such as a Microsoft Excel or Access. Important information in a lichen database can include site, substrate (see Lesson Plan "Collecting Lichens") and the following information categories:
2. **Collector:** the person who collected the lichen sample
3. **Collection number:** a unique number given to each collection made, starting with 1 for the first sample and continuing upwards (2, 3, 4....)
4. **Latitude/Longitude:** geographic location systems used for mapping the earth. Mapping datum should also be recorded if the exact location is to be relocated. Obtain latitude and longitude from a GPS, topographic map or from websites such as www.topozone.com. Record in decimal degrees (XX.XXXX° N and XX.XXXX° W in North America). Two decimal places puts the site within 1 km of the true location, four to five decimal places are best if the site is to be relocated.

5. **Elevation:** height above sea level, in meters. Obtain from an altimeter, GPS, or topographic map.
6. **Notes:** Anything the collector deems noteworthy or information later observed in identifying the lichen (see Lesson Plan 5 “Identifying Common Macrolichens to Genus”).
7. **Herbarium:** the physical place where lichen specimens are stored. This can be as simple as a shoe box or as fancy as metal file cabinets in climate controlled rooms. Also refers to the building where processing and permanent storage of botanical specimens occurs.

Page of Labels

Example Packet Label



Teacher Preparation

1. Learn to fold packets.
2. Download Template Lichen Database to the computers to be used for data entry.
3. Obtain boxes, paper and cards for collections.

Making Connections

This lesson plan is a continuation of “Collecting Lichens”, preserving lichens in an herbarium until samples can be identified as described in “Lichen Identification”. Creating herbaria is prerequisite skill for more complex lesson plan, such as monitoring pollution with lichens.

Check for Understanding

1. What is an herbarium and why might it be important?
2. Do you think there are ways to improve your herbarium database, packets or filing system?
3. Why is recording the site and habitat important information when collecting from the perspective of an herbarium?

**See 'Additional Resources and References' page
for more information.**