

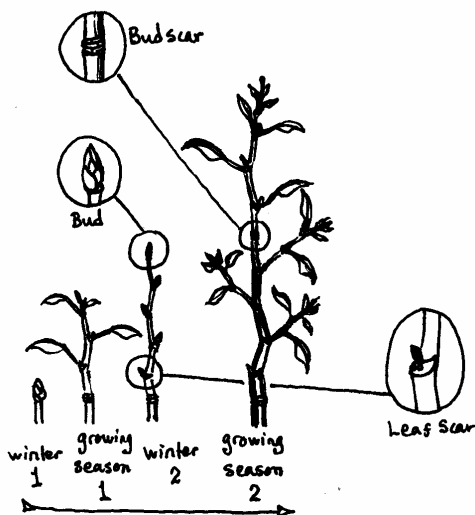
Lichen Succession on Twigs: an Ecological Learning Tool

INTRODUCTION

Plant communities are comprised of all the populations of plants inhabiting a common environment and interacting with one another. A characteristic of plant communities that is important for natural resource management is **succession**. Succession is the process by which a community changes over time. A patch of bare soil will often first develop grass, then small shrubs, and perhaps eventually an forest. Each change in the environmental community is a successional step. In this lab, we will investigate succession of lichens on twigs by viewing the changes in lichen populations.

A **lichen** is a mutualistic relationship between a fungus and a photosynthetic partner. The two partners share the same organismal body and are often mistaken for moss or fungi. The fungal partner primarily provides the structural body in which the alga is embedded. The photosynthetic partner is usually an alga, but is sometimes a cyanobacterium. The alga provides energy via the processes of photosynthesis. The partnership allows lichen to live in places where neither the alga nor the fungi could live alone.

Lichen thrives under a variety of conditions. They grow on soil, rocks, tree trunks, leaves, fence posts, gravestones and many other substrates. A portion of the Nambi Desert in Southern Africa is covered in a shrub-like lichen. In Antarctica there are only two species of vascular plants but around 350 species of lichen. Lichens have been used for food, ancient medicines, dyes, perfumes, and cosmetics. In addition, lichens have served as indicators of air quality and metal contamination. These and many other qualities make lichens a rich part of the natural environment.



Learning Objectives:

- Understand of the concept of succession by studying an example in the field.
- Become aware of lichen as a distinct group of organisms within the plant community.
- Learn to identify selected lichen genera.
- Learn techniques used by ecologist in investigating plant communities.

Key Terms:

Succession: the process by which a community changes over time.

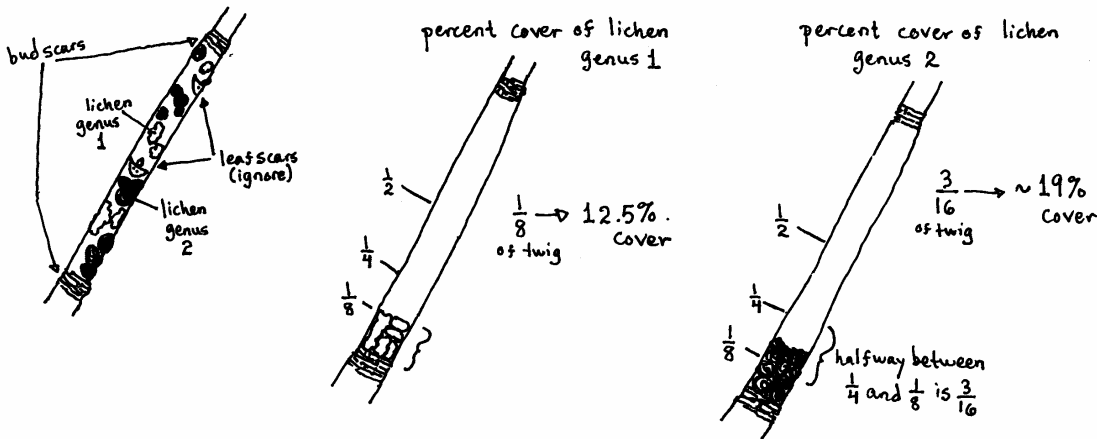
Lichen: a mutualistic relationship between a fungus and a photosynthetic partner.

Cover: the amount of an area that is beneath a particular species.

To determine the succession of the lichen communities in this lab, we will date the twigs by using the **bud scale scars**. Bud scales are formed each year on the end of new growth. After the bud has grown into a shoot, there is a scar left which marks a season of growth. A bud scar is typically a dark, slightly raised ring around the twig. The bud scars often become less obvious as the plant ages. These bud scale scars can be used to age a twig by counting back from the new end of the twig. The twig segment between each bud scale scar represents a year in age.

We will describe the community by estimating the **percent cover** of each lichen genus. Cover is the amount of an area that lies beneath a particular species.

This allows us to determine the abundance of the genera and compare twig segments. In this lab, cover is the amount of the twig that each lichen genus conceals in a segment.



MATERIALS NEEDED

Required: magnifying glass, hand pruners, metric ruler, dark marker

Optional: hand lens, tree pruners

PROCEDURE

Part I: Twig Collection (**Be sure to obtain permission before removing any plant material**)

1. Break the class into four groups (ideally 3 to 8 people per group). Each group will be responsible for collecting one twig.
2. Walk around the entire area and survey the environment. Take note of the differences in lichen on different trees and shrubs.
3. On Part I-A of your data sheets, make a brief description of the area. Record the relative canopy cover by analyzing how much light gets through to your level. Full coverage would be a canopy that lets little light through, partial would let some to most of the sunlight through, and no canopy coverage would be full sunlight.
4. Next record dominant trees and shrubs in the area. This can be done by using general common names: oak, pine, azelea, etc.
5. In your group, select a tree or shrub from which to cut your twig.
6. On Part I-B of your data sheets, record the type of plant your twig is from and some information about that plant.
7. Identify a twig you wish to sample. Optimally, twigs should be an easy size to work with and be home to obvious lichen communities. Make sure that this branch has not been previously pruned. Identify the bud scale scars (refer to introduction). Depending on the branch, you will want to remove at least six years of growth. Cut the twig from the branch above the sixth or seventh year growth.

Part II: Twig Analysis (back in the classroom)

1. Identify the segments of the twig. A segment is the length of the twig between bud scale scars. Using a dark marker to mark each bud scale scar on the twig.
2. You will be analyzing four consecutive years starting from the first lichen-containing segment. Put the new growth on your right. Locate the lichen population that is closest to

the new growth. The segment containing this population is segment A. The next oldest twig segment (the segment top the left of segment A) is segment B, the next oldest is segment C, and the oldest segment you will be analyzing is segment D.

3. Age the twig segment by counting the total number of bud scale scars between your segment and the new growth. Record the age on Part II of your data sheets.
4. Identify the lichen genera present on each segment of each twig. Handouts and pictorial examples from the website can be used to aid in this process. Only concentrate on lichen located on the main axis of the twig. Ignore lichen on any side branches. Record genera names on Part II of your data sheets. Unidentified genera can be recorded as "unknown" or you can use a short description of the lichen, for example "small flat brown."
5. Determine the percent cover (refer to introduction). of each lichen genus in each segment by visually placing all the lichen of each genus at one end of the segment and estimating what percent of the segment that genus covers. Record this number in Part II of your data sheets.
6. Determine the percent cover for any moss on the twig segment.
7. Repeat steps three through five for all lichen genera (including any unknowns).
8. Fill in the remainder of your Part II data sheets based on the information collected.
9. Trade twigs with another group. Repeat steps two through nine for each twig.

RESULTS

Using the information you have collected and determined in this lab, answer and discuss questions in Part III.

PART I

NAME: _____

A. ECOSYSTEM

Description (e.g. conifer forest): _____

Canopy Cover (full, partial, none): _____

Dominant Trees (common names)	Dominant Shrubs (common names)

B. TWIG SELECTION

Fill in the information for the twig you collected. Obtain the information for the other twigs from the other groups.

	Conifer or Hardwood	Description of plant location (shady, hillside, etc.)
Twig 1		
Twig 2		
Twig 3		
Twig 4		

PART II

NAME: _____

TWIG # _____

		Segment A	Segment B	Segment C	Segment D
1	Age				
2a	Lichen genus				
2b	Percent Cover				
3a	Lichen genus				
3b	Percent Cover				
4a	Lichen genus				
4b	Percent Cover				
5a	Lichen genus				
5b	Percent Cover				
6a	Lichen genus				
6b	Percent Cover				
7a	Lichen genus				
7b	Percent Cover				
8	Total % Lichen Cover (add all "b" lines)				
9	Dominant Lichen genera				
10	Richness (Total # of lichen genera)				
11	Percent Cover of Mosses				

PART II

NAME: _____

TWIG # _____

		Segment A	Segment B	Segment C	Segment D
1	Age				
2a	Lichen genus				
2b	Percent Cover				
3a	Lichen genus				
3b	Percent Cover				
4a	Lichen genus				
4b	Percent Cover				
5a	Lichen genus				
5b	Percent Cover				
6a	Lichen genus				
6b	Percent Cover				
7a	Lichen genus				
7b	Percent Cover				
8	Total % Lichen Cover (add all "b" lines)				
9	Dominant Lichen genera				
10	Richness (Total # of lichen genera)				
11	Percent Cover of Mosses				

PART II

NAME: _____

TWIG # _____

		Segment A	Segment B	Segment C	Segment D
1	Age				
2a	Lichen genus				
2b	Percent Cover				
3a	Lichen genus				
3b	Percent Cover				
4a	Lichen genus				
4b	Percent Cover				
5a	Lichen genus				
5b	Percent Cover				
6a	Lichen genus				
6b	Percent Cover				
7a	Lichen genus				
7b	Percent Cover				
8	Total % Lichen Cover (add all "b" lines)				
9	Dominant Lichen genera				
10	Richness (Total # of lichen genera)				
11	Percent Cover of Mosses				

PART II

NAME: _____

TWIG # _____

		Segment A	Segment B	Segment C	Segment D
1	Age				
2a	Lichen genus				
2b	Percent Cover				
3a	Lichen genus				
3b	Percent Cover				
4a	Lichen genus				
4b	Percent Cover				
5a	Lichen genus				
5b	Percent Cover				
6a	Lichen genus				
6b	Percent Cover				
7a	Lichen genus				
7b	Percent Cover				
8	Total % Lichen Cover (add all "b" lines)				
9	Dominant Lichen genera				
10	Richness (Total # of lichen genera)				
11	Percent Cover of Mosses				

PART III

NAME: _____

Questions and Discussion

1. What lichen genera are found on twigs under full canopy cover?

Partial canopy cover?

No canopy cover?

2. What lichen genera are found on hardwoods?

What lichen genera are found on conifers?

3. Fill in the table below for the four most common genera. Average the percent cover for each lichen genus for each year. For example:

Percent Cover by Lichen Genera per Year

	Genus			
Age				
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
Total				

4. Which lichen genera were present on the youngest segments?

5. Which lichen genera were present on the oldest segments?

6. Is there a difference in the distribution of lichen genera based on segment age? Explain why or why not this difference is present.

7. What does this indicate about the succession of each lichen genus found?

8. What would you expect the lichen community on the one year old segment of your first twig to look like in five years if it were still on the tree?