

Tutorial for Teachers



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Learning Lichens with Students

Lessons developed by Sarah Thorne

Funded by: White Mountain Interpretive Association, Kiwanis International,

Cooperating organizations: White Mountain National Forest, Prospect Mt.

High School, Alton, NH



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Learning Lichens in Lesson 1:

- Students will learn that lichens are:
 - **symbiotic** pairings of a fungus and alga or cyanobacteria
 - affixed to substrates such as trees and rocks
 - “air plants” without roots or vascular systems, readily absorb pollutants and minerals from rain, fog and air
 - used as **bioindicators** of air pollutants

Learning Lichens in Lesson 2:

- Students will be able to **compare** and contrast lichens, moss, fungi, and vascular plants.
- Students will learn to recognize these **growth forms** of lichens:
 - Fruticose
 - Foliose
 - Crustose

Learning Lichens in Lesson 3:

- Students will develop a **research question** and **inventory lichen** in the schoolyard or forest
- Students will analyze and present their results

Learning Lichens in Lesson 4:

- Students will apply what they have learned about lichen ecology and **biomonitoring** to the problem of air pollution
- Students will write an **essay** to demonstrate what they have learned

Materials available to teachers:

- Lesson Summary Table
- Student worksheets for the 4 lessons
- Belt transect protocol
- **Learning Lichens with Students** PowerPoint, intended for teacher preparation (including photos)
- **How to Conduct a Lichen Inventory (lesson 3)** PowerPoint
- Resource list

Lessons are available online at:

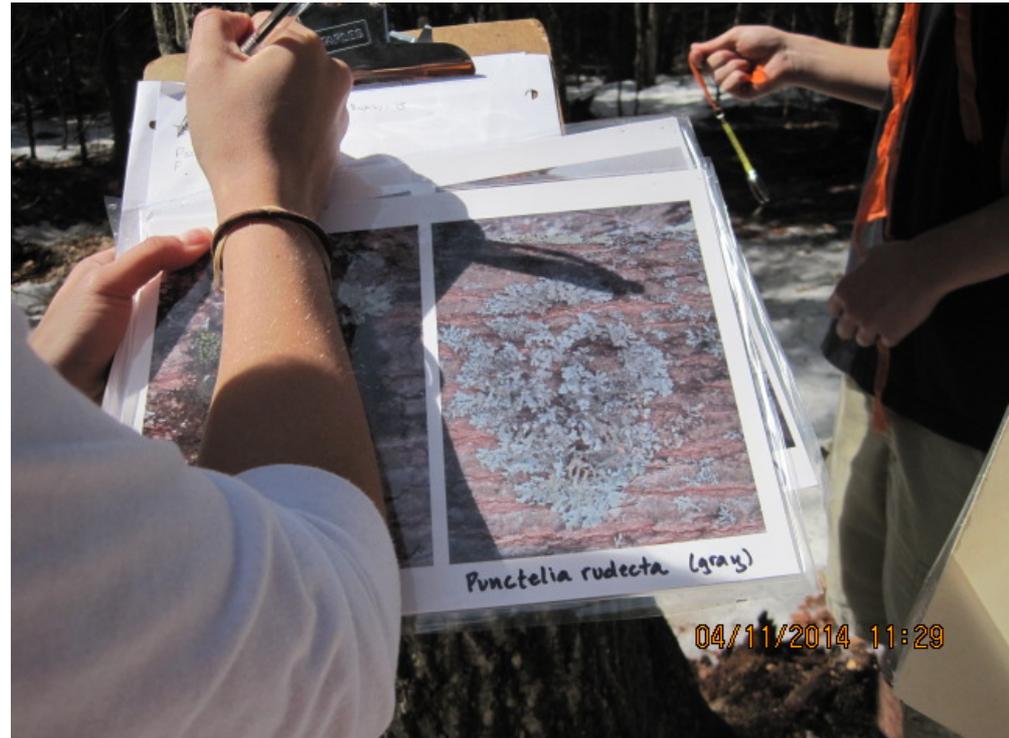
- www.

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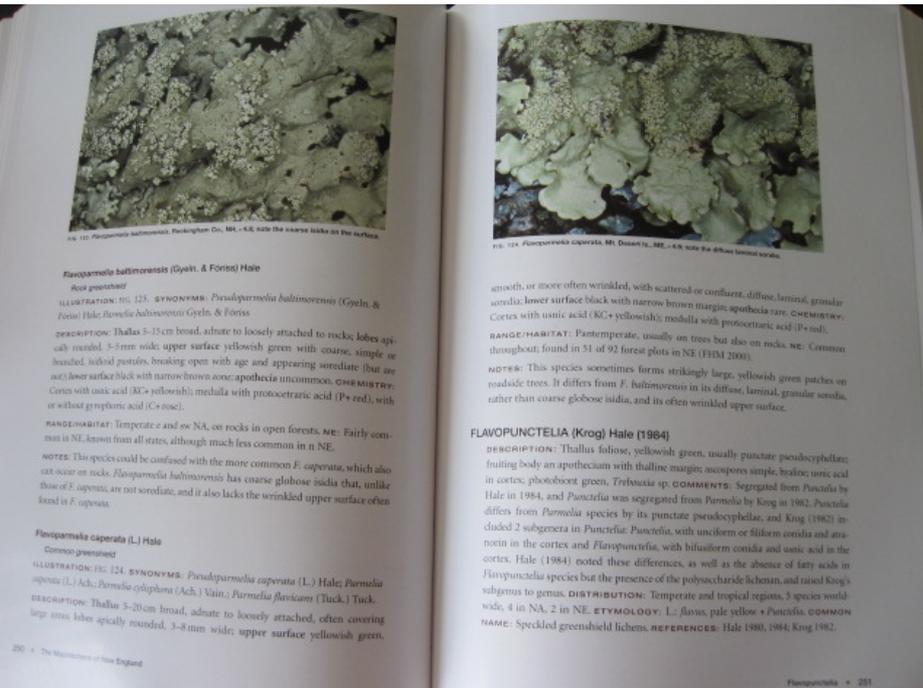
Lichen ID

- A challenge, but you don't have to learn hundreds of species!
- Photograph the common lichens in your sampling area
- Find a local lichen expert to confirm your identifications
- Make photo ID cards for field use by students



Your best ID friend

- **The Macrolichens of New England** from The New York Botanical Garden Press, 2007



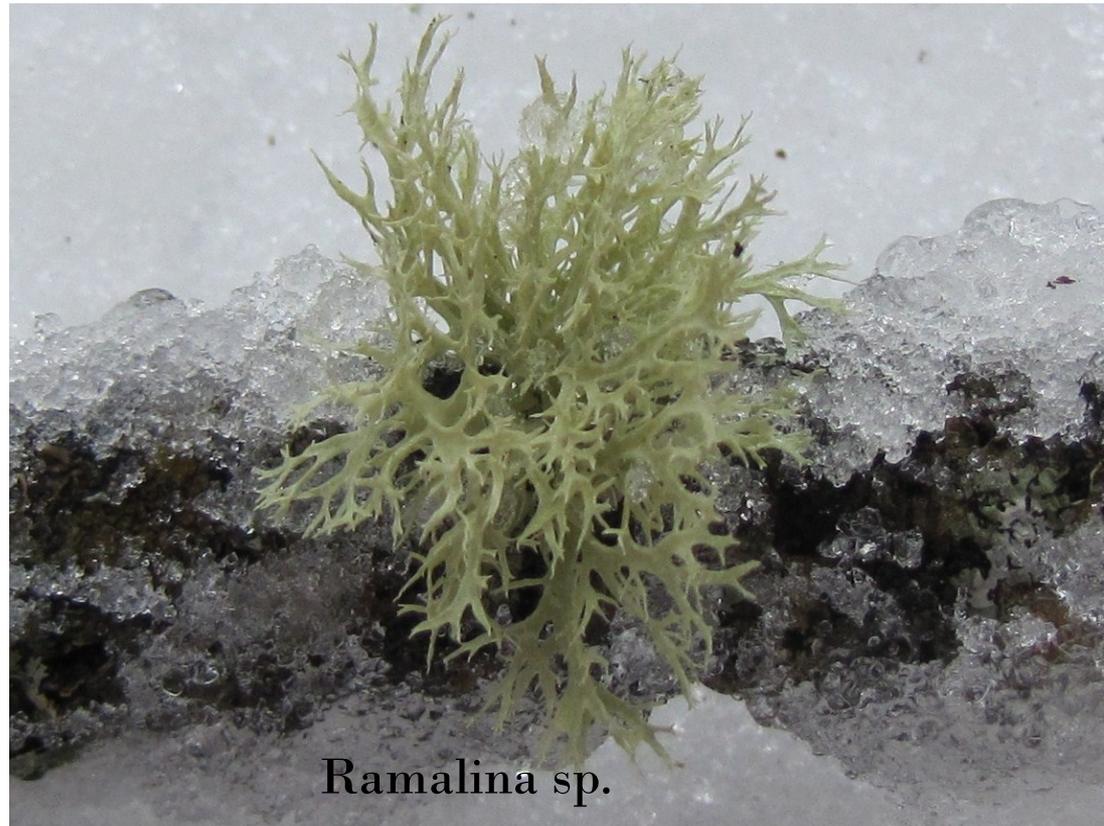
Lichen neighbors in New Hampshire

- The following slide gallery shows common NH lichen, and a few tree growing mosses and liverworts for comparison. (photos taken in Holderness and Alton, NH)
- You can provide these color photos to students for use in their field inventory work.
- These photos may be used for educational purposes with credit to the photographer.



Fruticose Lichens

- Shrub-like
- Branching
- Hair or beard-like
- No distinguishable upper and lower surfaces



Evernia sp.
(fruticose lichen)



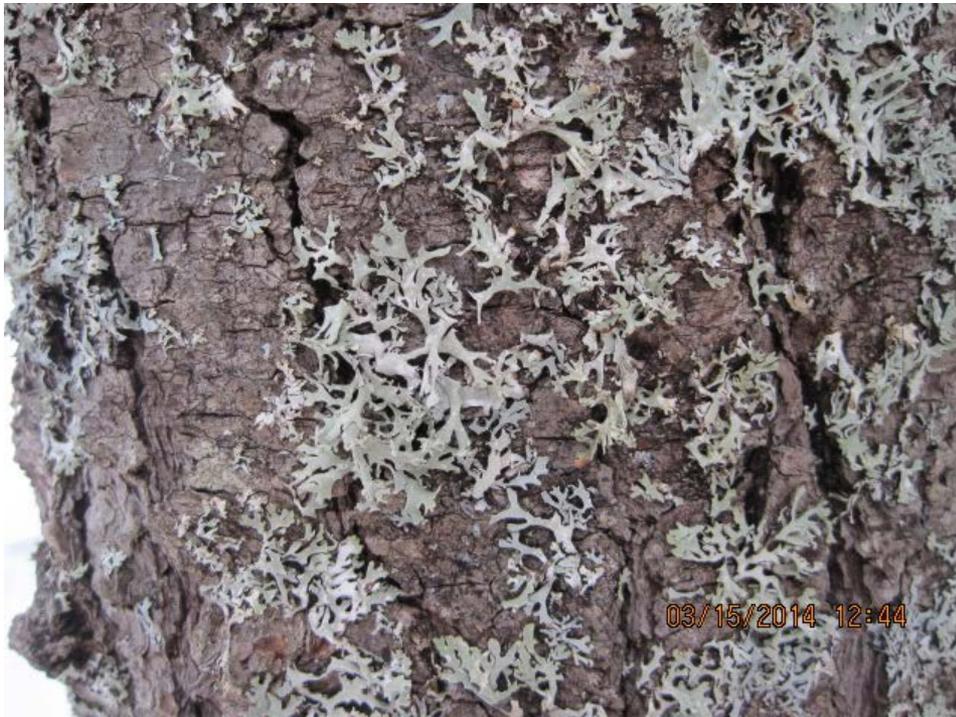


Usnea sp.
(fruticose lichen)

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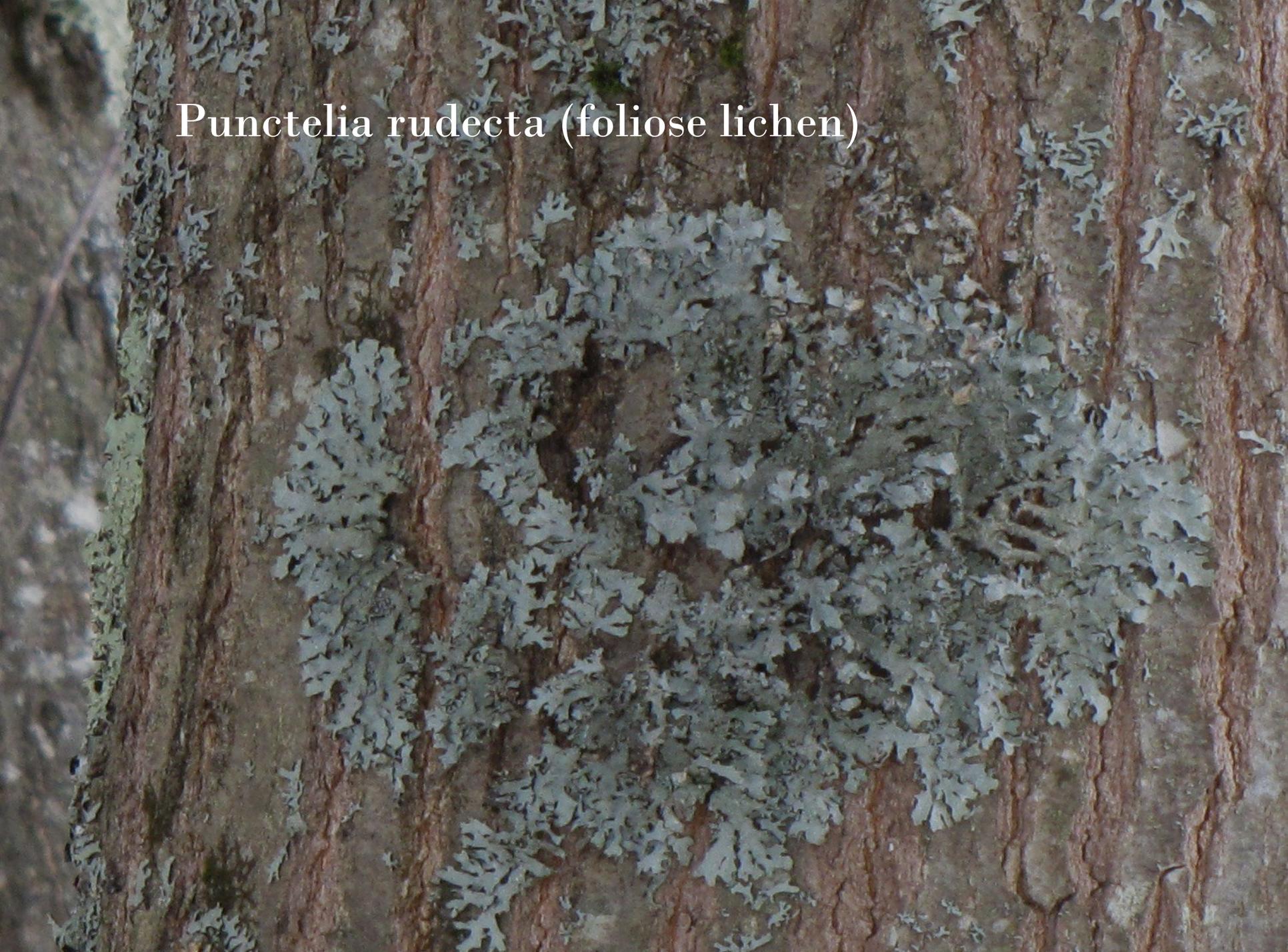
Foliose Lichens

- “leafy” with distinct top and bottom sides
- can be relatively flat, or raised



- Thallus mostly free from substrate

Punctelia rudecta (foliose lichen)



Plasmatia tuckermanii

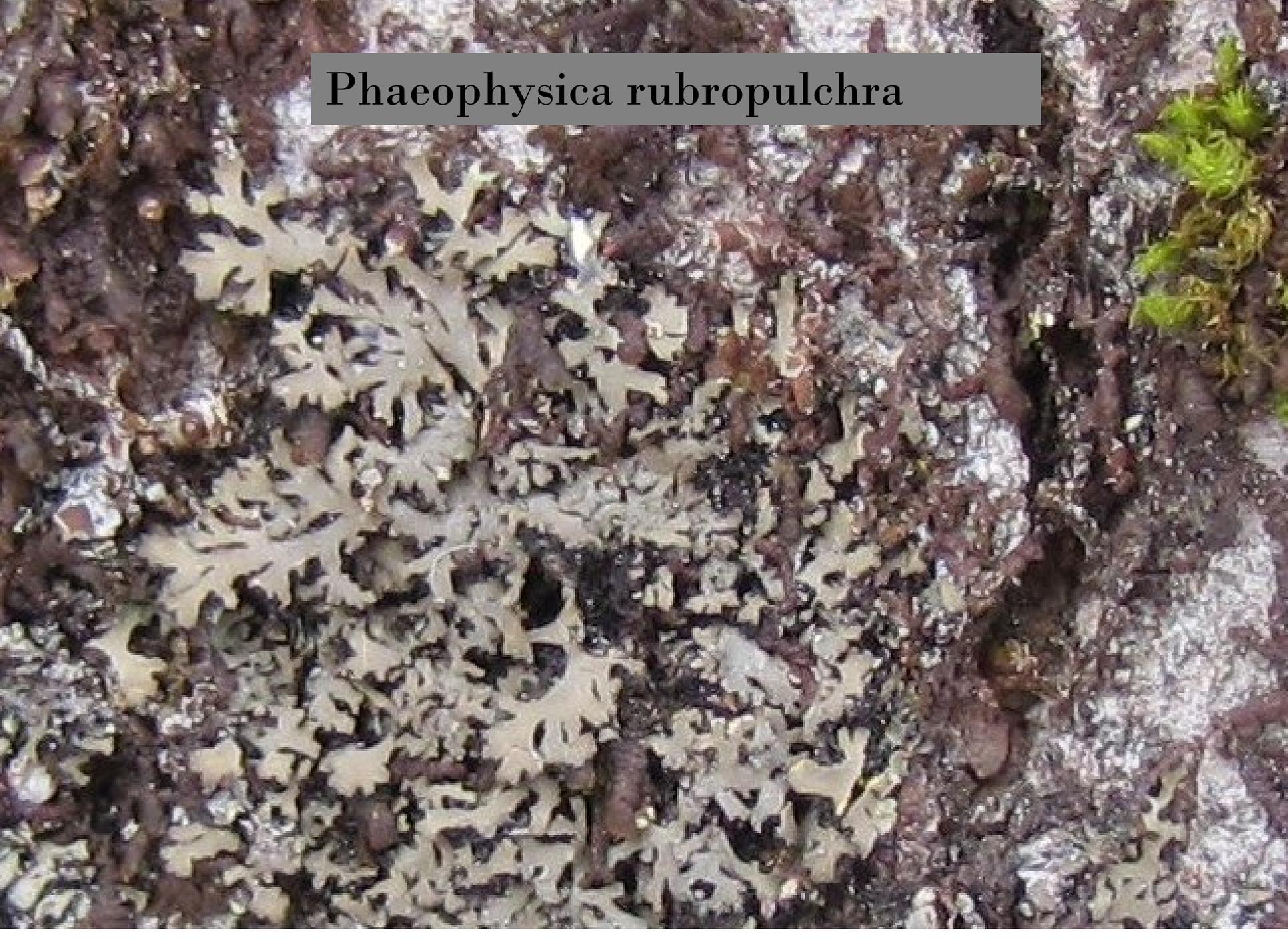
(foliose lichen)



Flavoparmelia sp.
(foliose lichen)



Phaeophysica rubropulchra





Parmelia sulcata
(foliose lichen)



Hypogymnia sp.
(foliose lichen)

Crustose Lichens

- Flat
- Grow tightly against substrate
- No lower side or rhizines



Crustose Lichens (many species)

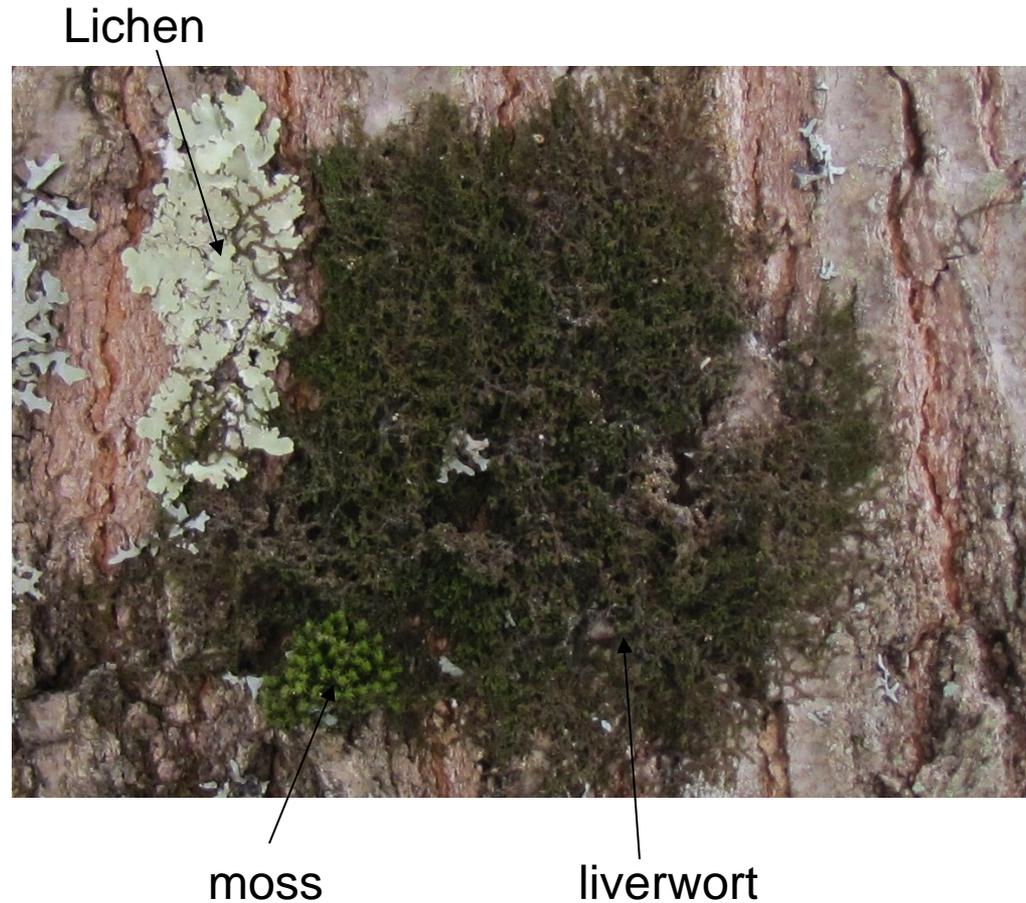


Cryptogams

- Don't reproduce by seed
- Lichen often grow with other cryptogams such as mosses and liverworts, which are also non-vascular, having no xylem or phloem

Lichen Imposters

- But, unlike lichen, mosses and liverworts are primitive plants
- Students can inventory these as well, if desired



Moss

- Erect shoots
- Reproduce with spores
- Leaf and root-like structures
- Very green, Chlorophyll throughout
- Non-vascular



Ulota crispa

Pylaisiella sp. (flat moss)

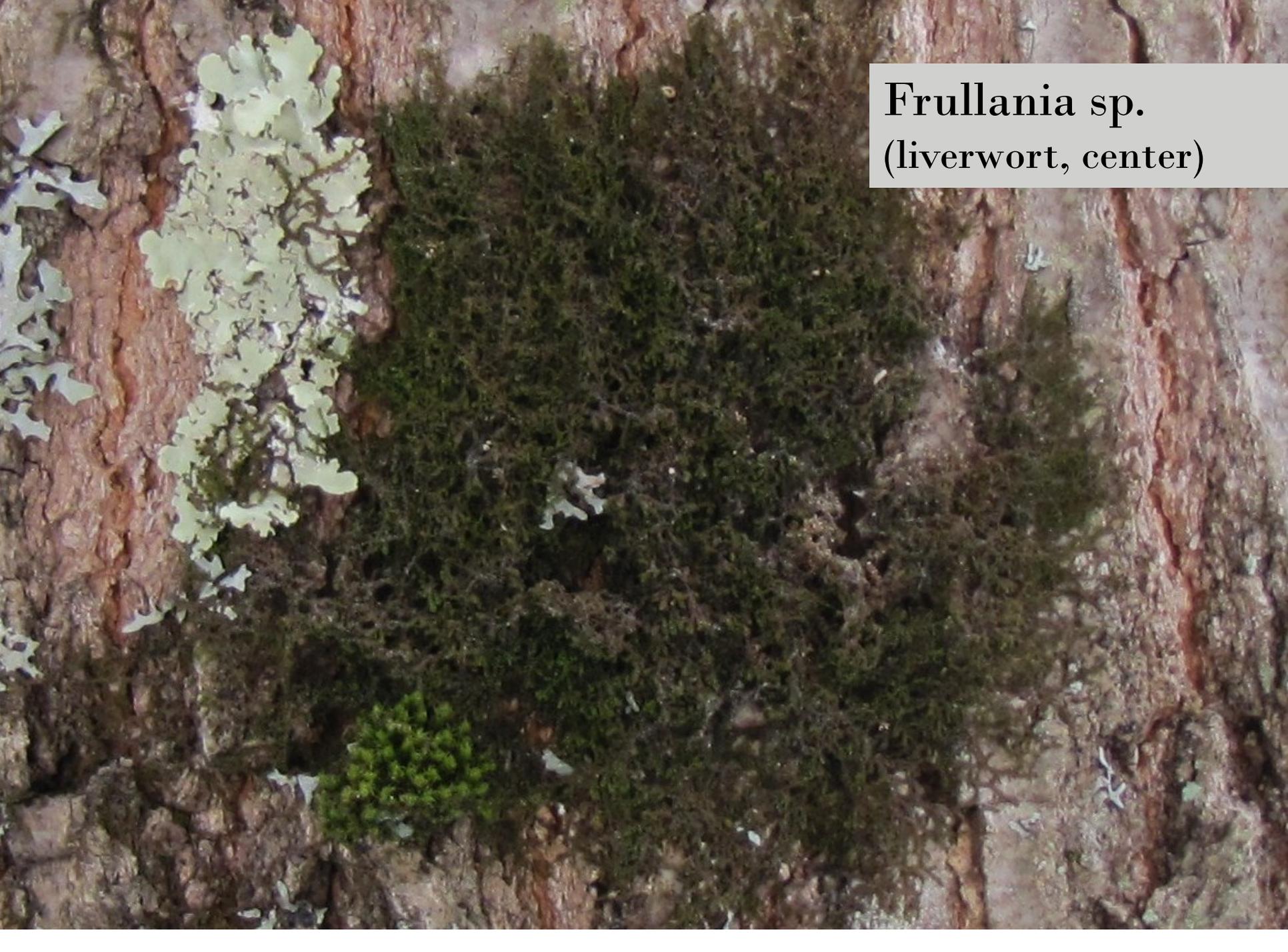


Liverworts

- Non-vascular
- Usually in moist conditions
- tough “leaves”



Radula complanata

A close-up photograph of a tree trunk with reddish-brown, textured bark. A large, dense patch of dark green, leafy liverwort (Frullania sp.) is growing in the center. To the left, there is a smaller, lighter green, lobed liverwort. The background is slightly blurred, showing more of the tree trunk and some small white spots.

Frullania sp.
(liverwort, center)