

Teachers Guide

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“Lichens: Two Lives in One” Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalists article “Lichens: Two Lives in One” by Todd Whitesel. Published in the January–February 2006 *Minnesota Conservation Volunteer*, or visit www.dnr.state.mn.us/young_naturalists/lichens.

Young Naturalists teachers guides are provided free of charge to classroom teachers, parents, and students. This guide contains a brief summary of the article, suggested independent reading levels, word count, materials list, estimates of preparation and instructional time, academic standards applications, preview strategies and study questions overview, adaptations for special needs students, assessment options, extension activities, Web resources (including related Conservation Volunteer articles), copy-ready study questions with answer key, and a copy-ready vocabulary sheet. There is also a practice quiz in Minnesota Comprehensive Assessments format. Materials may be reproduced and/or modified to suit user needs. Users are encouraged to provide feedback through an online survey at www.dnr.state.mn.us/education/teachers/activities/ynstudyguides/survey.html.



Summary

“Lichens: Two Lives in One” describes one of nature’s true partnerships, the formation of lichens by algae and fungi. Numerous photographs and illustrations help the reader comprehend the structure and function of lichens. Students learn about the characteristics and habitats of Minnesota’s three most common lichen forms: crustose, foliose, and fruticose.

Suggested reading levels: middle through high school

Total words: 1,498

Materials: Paper, poster board, pencils, pens, markers, print resources from your

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media center, birds of Minnesota field guide, specimens of lichens growing near your school, magnifying glasses, and microscopes.

Preparation

time: One to two hours, not including extensions

Estimated instructional

time: Two to three 50-minute class periods, not including extensions

Minnesota Academic Standards applications:

“Lichens: Two Lives in One” may be applied to the following Minnesota Department of Education Academic Standards:

Language Arts

I. Reading and Literature

- A. Word Recognition, Analysis and Fluency
- B. Vocabulary Expansion
- C. Comprehension

II. Writing

- A. Types of Writing
- B. Elements of Composition
- C. Spelling
- D. Research
- E. Handwriting and Word Processing

III. Speaking, Listening and Viewing

- A. Speaking and Listening
- B. Media Literacy

Science

Grade 7

IV. Life Science

- A. Cells
- B. Diversity of Organisms
- C. Interdependence of Life
- F. Flow of Energy and Matter

Grade 8

III. Earth and Space Science

- A. Earth Structure and Processes (Students will investigate the impact humans have on the environment.)

Grade 9–12

III. Earth and Space Science

- A. Earth Structure and Processes (Students will investigate the impact humans have on the environment.)

IV. Life Science

- A. Cells
- B. Diversity of Organisms
- C. Interdependence of Life
- F. Flow of Energy and Matter

Arts: Artistic Expression: Visual Arts

Complete Academic Standards are available at www.education.state.mn.us. Teachers who find other connections to academic standards are encouraged to contact *Minnesota Conservation Volunteer*.

Preview

Begin your preview with a survey of the article. Ask your students to examine the photos and illustrations. Use the **KWL** strategy (Ogle, 1986)

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to find out what your students already know (**K**) about fungi, algae, and lichens; what they would (**W**) like to learn, and eventually, what they learned (**L**) while reading the article and related materials, and through participating in extension activities. Display your **K** and **W** ideas on poster board or paper (see Vocabulary preview, below). Add to your **L** list as you read and discuss the article. See www.teach-nology.com/web_tools/graphic_org/kwl for a **KWL** generator that will produce individual organizers for your students.

Vocabulary preview

This article includes a number of challenging vocabulary words. Therefore, you may wish to review the attached list and italicized words, and add other words based on your students’ needs. Many connections to vocabulary in the article may be made during the KWL activity. Ask students to highlight the italicized words. These are key concepts and should be discussed before reading. Perhaps some of these terms are included in your K list. If students are not familiar with some of the terms, include them in the W list. Eventually they can be moved to the L list. Consider writing vocabulary words on the KWL chart in a contrasting color of ink.

Study questions overview

Study questions parallel the story (the answer to the first question appears first in the article, followed by the second, and so on). This is an important organizational tool for students and should be emphasized before you begin working on the study questions. Preview the entire guide with your class before you read the article. You may wish to read the story aloud and complete the study questions in class or in small groups. The questions may be assigned as homework, depending on the reading ability of your students. Inclusion teachers may provide more direct support to special needs students (see Adaptations section, below). The study questions may be also used as a quiz. Note: Items 2, 6, 8, 9, and 12 require inferential thinking.

Adaptations

Read aloud to special needs students. Abbreviate the study questions or highlight priority items to be completed first. If time allows, remaining items may be attempted. For example, items 1, 3, 5, 13, and 14 will give students some basic knowledge of lichens. Peer helpers, paraprofessionals, or adult volunteers may lend a hand with the study questions. With close teacher supervision, cooperative groups can also offer effective support to special needs students, especially for extension activities.

Assessment

You may use all or some of the study questions, combined with vocabulary, as a quiz. Other assessment ideas:

1. Students may write an essay describing the symbiotic relationship between fungi and algae.
2. Ask students to label a cross-section diagram of a lichen or to draw and label the cross section themselves (See Extension activity 2).

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Assessment continued

3. Posters illustrating the relationship of air and water pollution to lichen survival, or symbiosis, may be an alternative to an essay.
4. Specimen or photos of common species may be named and/or matched to habitat.
5. Students may, in essays and/or oral presentations, explain how lichens benefit people.

Extension activities

1. Several species of lichens may be growing right outside your classroom door. Take a walk to collect specimens to study.
2. Examine specimens under magnification to gain a better appreciation of the structure and diversity of lichens.
3. Symbiosis, a central concept of this article, provides an opportunity to challenge students to expand their understanding of relationships between organisms throughout nature. Wikipedia (en.wikipedia.org/wiki/symbiosis) is a good place to start, while www.ms-starship.com/sciencenew/symbiosis.htm and people.bu.edu/iss/ are excellent sites for further study. Students may share their knowledge in poster presentations.
4. Lichens are used to make many products. See www.lichen.com for “Lichens and People.” Challenge your students to find out more about how people use lichens.
5. Use a field guide to become familiar with birds that use lichens as nesting material.

Web resources

Backyard Nature on lichens:

www.backyardnature.net/lichens.htm

Endangered lichens:

www.botany.hawaii.edu/cpsu/endlich.html

Lichens and pollution:

www.earthlife.net/lichens/intro.html

Lichen biology:

helios.bto.ed.ac.uk/bto/microbes/lichen.htm

A related *Minnesota Conservation Volunteer* article is available online:

“The Secret Lives of Fungi,” September–October 2005

www.dnr.state.mn.us/volunteer/septoct05/fungi.html

Other related articles are available by request: To request a hard copy of these articles, please send the name of the article, issue months and year of publication, and your mailing address to mcvarticles@dnr.state.mn.us.

“How to Spot a Polypore,” July–August 1989

“Lichens Everywhere!” July–August 1986

“Toxic Algae: Threat to Pets, Livestock,” July–August 1983

“The Microscopic World of Algae,” July–August 1981

“Lichens as a Hobby,” March–April 1978

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- References** Ogle, D.S. K-W-L Group Instructional Strategy. In A.S. Palincsar, D.S. Ogle, B.F. Jones, and E.G. Carr (Eds.), *Teaching Reading as Thinking* (Teleconference Resource Guide, pp.11–17). Alexandria, Va.: Association for Supervision and Curriculum Development, 1986.

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Study Questions

“Lichens: Two Lives in One,” by Todd Whitesel

Minnesota Conversation Volunteer, January–February 2006

www.dnr.state.mn.us/young_naturalists/lichens

Name _____ Period _____ Date _____

1. How is a lichen different from a plant or an animal? _____

2. Is a lichen a mushroom? Why or why not? _____

3. How do algae benefit lichens? _____

4. What is the relationship between fungi and algae called? _____

5. Why are lichens compared to sponges? _____

6. When do lichens become dormant? Why? _____

7. Explain how spores make new lichens. _____

8. Compare and contrast the three main forms of lichens: crustose, foliose, and fruticose. _____

9. Where do you think hammered shield lichen got its name? _____

10. Lichens are sometimes call “colonizers.” Why? _____

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11. Explain how lichens help turn rocks into soil. _____

12. If you are interested in seeing a wide variety of lichens, where in Minnesota might you look? Why? _____

13. How does sulfur dioxide affect lichens? _____

14. How do lichens benefit animals and humans? _____

15. Match the words to their definitions.”

a. lichenologist

b. litmus

c. photosynthesis

d. colonizers

e. symbiosis

first organisms to grow

relationship that benefits both organisms

person who studies lichens

how plants make food

blue coloring

Study Questions Answer Key

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1. How is a lichen different from a plant or animal? **Lichens are two organisms, fungi and algae, that live together.**
2. Is a lichen a mushroom? Why or why not? **No. Mushrooms are fungi that do not need algae to live.**
3. How do algae benefit lichens? **Algae make the food (energy) lichens need to survive.**
4. What is the relationship between fungi and algae called? **Symbiosis**
5. Why are lichens compared to sponges? **Lichens can absorb up to 20 times their weight in water.**
6. When do lichens become dormant? Why? **When there is no rain. Because they can't grow without water.**
7. Explain how spores make new lichens. **If a spore lands on an alga, it can combine with the alga to form a lichen.**
8. Compare and contrast the three main forms of lichens: **crustose, foliose, and fruticose. Answers will vary but should include both similarities and differences. For example, crustose forms grow slowly (1 inch/25 years), while foliose grow quickly (as much as 1 inch/year). All three present different colors within the form.**
9. Where do you think hammered shield lichen got its name? **It appears like hammered metal, and resembles the shape of a shield.**
10. Lichens are sometimes call *colonizers*. Why? **They are the first organisms to inhabit places where all other living things have died.**
11. Explain how lichens help turn rocks into soil. **Lichens break up rocks in two ways: They excrete acids that dissolve minerals, and they send rootlike threads into cracks that help break the rocks into tiny pieces.**
12. If you are interested in seeing a wide variety of lichens, where in Minnesota might you look? Why? **Go to Voyageurs National Park, because there are about 400 species of lichens living there.**
13. How does sulfur dioxide affect lichens? **Sulfur dioxide harms lichens' chlorophyll, which they need to make food for themselves.**
14. How do lichens benefit animals and humans? **Animals and birds use lichens for food and nest material. People use lichens for dyes and medicines.**
15. Match the words to their definitions.
 - a. lichenologist **person who studies lichens**
 - b. litmus **blue coloring**
 - c. photosynthesis **how plants make food**
 - d. colonizers **first organisms to grow**
 - e. symbiosis **relationship that benefits both organisms**

Minnesota Comprehensive Assessments Practice Items

"Lichens: Two Lives in One," by Todd Whitesel

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Name _____ Period _____ Date _____

- Lichens are a combination of _____ and _____?
 - plants and animals
 - fungi and algae
 - mushrooms and fungi
 - sulfur and dioxide
- Algae produce energy in a process called
 - carbohydrates.
 - pollution.
 - photosynthesis.
 - chlorophyll.
- Fruticose lichens grow on
 - rocks.
 - trees.
 - antlers.
 - A and B.
- About _____ lichen species are found in Minnesota.
 - 15,000
 - 15
 - 150
 - 750
- Clifford Wetmore studies the lichen in Voyageurs National Park in order to
 - find out if the air is polluted.
 - find if moose are eating too much of it.
 - find out if the air is cleaner now than it was 100 years ago.
 - A and C.

Minnesota Comprehensive Assessments Practice Items Answer Key

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1. Lichens are a combination of _____ and _____. **B. fungi and algae**
2. Algae produce energy in a process called **C. photosynthesis**
3. Fruticose lichens grow on **D. A and B.**
4. About _____ lichen species are found in Minnesota. **D. 750**
5. Clifford Wetmore studies the lichen in Voyageurs National Park in order to **D. A and C.**

Vocabulary

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www.dnr.state.mn.us/young_naturalists/lichens

algae aquatic single- or multi-celled plants

chlorophyll green coloring matter in plants

dormant in a state of suspended biologic activity

excrete discharge

fungi parasitic organisms that lack chlorophyll: molds, mildews, and mushrooms

species related individuals, capable of inter-breeding

organisms living things

poultice medicine spread on cloth and applied to sores; often heated before application

spores tiny structures fungi use for reproducing