

Young Naturalists Teachers Guide

Multidisciplinary classroom activities based on the Young Naturalists nonfiction story in Minnesota Conservation Volunteer, September–October 2020, www.mndnr.gov/mcvmagazine.

Minnesota Conservation Volunteer magazine tells stories that connect readers to wild things and wild places. Subjects include earth science, wildlife biology, botany, forestry, ecology, natural and cultural history, state parks, and outdoor life.

Education has been a priority for this magazine since its beginning in 1940. “One word—Education—sums up our objective,” wrote the editors in the first issue. Thanks to the MCV Charbonneau Education Fund, every public library and school in Minnesota receives a subscription. Please tell other educators about this resource.

Every issue now features a Young Naturalists story and an online Teachers Guide. As an educator, you may download Young Naturalists stories and reproduce or modify the Teachers Guide. The student portion of the guide includes vocabulary cards, study questions, and other materials.

Readers’ contributions keep Minnesota Conservation Volunteer alive. The magazine is entirely financially supported by its readers.

Find every issue online. Each story and issue is available in a searchable PDF format. Visit <http://www.mndnr.gov/mcvmagazine> and click on past issues.

Thank you for bringing Young Naturalists into your classroom!

“The Soil is Alive!” Multidisciplinary Classroom Activities

Prepared by Mary Hoff and Julie Athman Ernst

Teachers guide for the Young Naturalists article “The Soil is Alive!” by Mary Hoff. Published in the September–October 2020 *Minnesota Conservation Volunteer*, or visit www.mndnr.gov/young_naturalists/soil.

Summary. Soil literally is the foundation of life on Earth. And healthy soil is teeming with life! This Young Naturalists story introduces readers to how soil forms, different types of soil, the life soil supports, and why and how we can keep soil healthy. Reading about and exploring soil through activities will help your students gain a better appreciation of, and sense of stewardship for, this precious but often-ignored resource.

Suggested Reading Level. Third through middle school grades

Materials: KWL organizer; optional resources for extension activities include paper cups, bean seeds, video viewing equipment, Internet access and other print and online resources your media specialist may provide.

Preparation Time: 15–30 minutes, not including time for extension activities

Estimated Instructional Time: 30–60 minutes, not including extension activities

Minnesota Academic Standards Applications:

“The Soil is Alive!” activities described below may be used to support some or all of the following Minnesota Department of Education standards for students in grades 3–8:

Science

**coding is based on the 2019 Commissioner approved draft of MN Academic Standards in Science and focuses on the three dimensions from the Framework for K-12 Science Education (NRC, 2012)*

Science and Engineering Practices

2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Crosscutting Concepts

2. Cause and effect
4. Systems and system models
6. Structure and function
7. Stability and change

Disciplinary Core Ideas

Life Sciences 2: Ecosystems: Interactions, energy, and dynamics

Earth and Space Sciences 3: Earth and human activity

Social Studies

History (Benchmarks 3.4.1.2.1, 3.4.1.2.2, 5.4.1.2.1, 6.4.1.2.1, 7.4.1.2.1)

Language Arts

Reading Benchmarks: Informational Text

Key Ideas and Details (Benchmarks 3.2.1.1, 3.2.3.3, 4.2.1.1, 4.2.3.3, 5.2.1.1, 5.2.3.3, 6.5.1.1, 7.5.1.1, 8.5.1.1)

Craft and Structure (Benchmarks 3.2.4.4, 3.2.5.5, 4.2.4.4, 4.2.5.5, 5.2.4.4, 5.2.5.5, 6.5.4.4, 7.5.4.4, 8.5.4.4)

Integration of Knowledge and Ideas (Benchmarks 3.2.7.7, 4.2.7.7, 4.2.9.9, 5.2.7.7, 5.2.9.9, 6.5.7.7)

Writing Benchmarks

Text Types and Purposes (Benchmarks 3.6.1.1, 3.6.2.2, 4.6.1.1, 4.6.2.2, 5.6.1.1, 5.6.2.2, 6.7.1.1, 6.7.2.2, 7.7.1.1, 7.7.2.2, 8.7.1.1, 8.7.2.2)

Research to Build and Present Knowledge (Benchmarks 3.6.7.7, 4.6.7.7, 5.6.7.7, 6.7.7.7, 7.7.7.7, 8.7.7.7)

Speaking, Viewing, Listening and Media Literacy Benchmarks

Comprehension and Collaboration (Benchmarks 3.8.1.1, 3.8.4.4, 4.8.1.1, 4.8.4.4, 5.8.1.1, 5.8.4.4, 6.9.1.1, 7.9.1.1, 8.9.1.1)

Language Benchmarks

Vocabulary Acquisition and Use (Benchmarks 3.10.4.4, 4.10.4.4, 5.10.4.4, 6.11.4.4, 6.11.6.6, 7.11.4.4, 7.11.6.6, 8.11.4.4, 8.11.6.6)

Reading Benchmarks: Literacy in Science and Technical Subjects 6-12

Key Ideas and Details (Benchmark 6.13.1.1)

Integration of Knowledge and Ideas (Benchmark 6.13.8.8)

Reading Benchmarks: Literacy in History/Social Studies 6-12

Key Ideas and Details (Benchmark 6.12.1.1)

Integration of Knowledge and Ideas (Benchmarks 6.12.7.7, 6.12.8.8)

Writing Benchmarks: Literacy in Science and Technical Subjects 6-12

Text Types and Purposes (Benchmark 6.14.1.1)

Research to Build and Present Knowledge (Benchmark 6.14.7.7)

Arts

Artistic Process: Create or Make (Benchmarks 0.2.1.5.1, 0.2.1.5.2, 4.2.1.5.1, 4.2.1.5.2, 6.2.1.5.1, 6.2.1.5.2)

Artistic Process: Perform or Present (Benchmark 0.3.1.5.1)

For current, complete Minnesota Academic Standards, see www.education.state.mn.us. Teachers who find other connections to standards are encouraged to contact *Minnesota Conservation Volunteer*.

Preview: In the classroom, pass around a jar with a cup of soil in it. Invite students to look closely at it and see if they notice anything they never noticed about soil before. (In an outdoor classroom, have students use a spade or spoon to loosen soil and pick up and examine a handful. If students are learning remotely, encourage them to go outdoors to examine soil in their backyard.) Then divide them into small groups to do a **KWL activity**. Within the groups, have students describe what they already know (**K**) about soil and what they wonder (**W**) about them. Give each student a copy of the organizer (see www.teach-nology.com/web_tools/graphic_org/kwl) and encourage each to make notes during the group discussion. As you read and discuss the article you can compile a list of what they learn (**L**) while reading the article and related materials and participating in extension activities.

Vocabulary Preview: You can find a copy-ready vocabulary list at the end of this guide. Feel free to modify it to fit your needs. Share the words with you students and invite them to share what they think they mean. Tell them you will be reading a story that will help them understand these words so they can own them in the future! As your students encounter these vocabulary words in the story, you may want to encourage them to infer meaning using context clues, such as other words in the sentence or the story's illustrations. Students also could be encouraged to compare their inferences as to what the words mean with their earlier guesses and with the definitions from the vocabulary list.

You might wish to use the study cards (adapted from [Strategic Tutoring](#)) found at the end of the study questions for this Young Naturalists feature. On one half of the card, in large letters, is a key vocabulary word with smaller letters framing the word in a question or statement. On the other half is the answer to the question or the rest of the statement. Cut along the horizontal line, fold in the middle, and tape or staple, then use like flash cards. We've included a few blanks so you or your students can add new words or phrases if you'd like.

Study Questions Overview: Preview the study questions with your class before you read the article. Then read the story aloud. Complete the study questions in class, in small groups, or as an independent activity, or use them as a quiz.

Adaptations: Read aloud to special needs students. Abbreviate the study questions or focus on items appropriate for the students. Adapt or provide assistance with extension activities as circumstances allow.

Assessment: You may use all or part of the study guide, combined with vocabulary, as a quiz. Other assessment ideas include: (1) Ask students to describe what they learned about soil. See the "learned" list from your KWL activity. (2) Have students write multiple-choice, true-false, or short-answer questions based on the article. Select the best items for a class quiz. (3) Divide students into two teams. Have teams take turns sharing facts game-show style about soil. List facts on the board as they are shared. See which team can come up with the most facts. (4) Have students create posters, podcasts, social media cards or videos to share their new knowledge with others.

Extension Activities: Extensions are intended for individual students, small groups, or your entire class. Young Naturalists articles provide teachers many opportunities to make connections to related topics, to allow students to follow particular interests, or to focus on specific academic standards.

1. Have students bring a cupful of soil to school. Each should describe the setting from which they got the soil. Give students a chance to examine the different samples and note similarities and differences in texture, color, smell, etc. Give each student two beans seeds and have them plant 1 inch deep in their soil. Help students make hypotheses about how well their bean seeds will grow, based on what they learned from reading the article (or from additional research into kinds of soil that are good for growing plants). Give each the same amount of water and access to sunlight, and observe them for a week after they sprout. Are some soil samples better than others for supporting your bean crop? Have students return to their hypotheses and think about and share their observations, discussing differences across the observations and soil samples. Older students could be asked to design and conduct a more controlled experiment to determine what type of soil is best suited for growing beans.

2. Learn about the Dust Bowl and the importance of soil conservation. You might find [classroom materials developed in conjunction with the Ken Burns PBS TV series](#) helpful. Students could be prompted to think about and describe the connections between the historical event and its ecological causes and effects, as well as the economic effects. Students could be encouraged to pose a specific question about the Dust Bowl that arises from their learning; pursue further learning (historical inquiry) about their question (such as gathering and organizing sources, analyzing sources for credibility and bias, citing sources, primary and secondary sources, multiple accounts of the same historical event); and then summarize what they learned through writing an informative text.

3. Are any of the parents of your students farmers, master gardeners, or others who work with soil? Invite them in to talk about soil health and how they take care of the soil they work with.

4. Is it possible that everything is connected to soil? Invite students to choose an object, any object. Then ask them to brainstorm ways their object is connected to soil. Is it made from plants that grew in the soil? Could it help or harm the soil? Whether it's a puppy, a bicycle, a hamburger or a barrette, if you think long enough you can likely uncover a link. Draw pictures depicting the connections.

5. Make a classroom compost pile. Follow the instructions at the end of the article, supplementing with information online or with help from a parent.

6. Learn about the use of clay soil to make pottery, then use local soil to make clay (a video like [this one](#) may help). Students can use the clay to make figures or pots.

7. See [Soil Experiments for Children](#) for simple activities that demonstrate soil erosion, water-holding capacity and more.

8. In small groups or as individual students, assign each student/group one of the living things found in soil (for example, microbes, invertebrates, etc.; see page 38). Ask students to create a poem and illustration to represent their living creature and the job it does in the soil. Students can present their poems and illustrations for peer feedback, and then use this feedback to improve their work toward a final draft that gets shared with the class or another audience.

9. Often environmental actions such as composting have pros and cons. You might find that your neighbor doesn't like your compost pile, or maybe it is the other way around! Have students investigate pros and cons of composting using multiple sources of information. Encourage students to think about the credibility of the sources they are using, and ultimately weigh the various advantages and disadvantages toward using evidence to support "an argument" for or against composting. Students should be

encouraged to integrate the information from several sources on the same topic to knowledgeably write or speak about the subject.

Web Resources: Check out the following if you'd like to dive deeper into some of the topics covered by this Young Naturalists feature.

General Teacher and Student Resources

[Minnesota DNR Teachers' Resources](#)

[DNR Kids Page](#)

Soil – General + Activities

[Dig Deeper](#) (with activities for different grade levels)

[Soils: Foundations for Life](#) (webinar for teachers)

[Soil Biology](#) (USDA Natural Resources Conservation Service)

[Five Factors of Soil Formation](#)

[Soil Experiments for Children](#)

Minnesota Soil

[MN Soil Map](#)

[Lester: Minnesota State Soil \(PDF\)](#)

[Soil Orders and Suborders in Minnesota](#)

Dust Bowl

[Introduction to the Dust Bowl](#) (PBS)

[Dust Bowl](#) (History Channel)

Composting

[Composting at Home \(USEPA\)](#)

[Kids Gardening: Composting](#)

Related Minnesota Conservation Volunteer Articles*

[The Roots of Healthy Habitat](#)

[Lester Soil](#)

[The Universe Underfoot](#)

*All *Minnesota Conservation Volunteer* articles, including past Young Naturalists stories and accompanying teachers guides, are [available online](#) in searchable PDF.

Study Questions

"The Soil is Alive!" by Mary Hoff. Published in the September–October 2020 *Minnesota Conservation Volunteer*, or visit www.mndnr.gov/young_naturalists/muskrats.

Name _____ Date _____

1. Layers of soil are called

a. ingredients

b. horizons

c. topsoil

d. vertisols

2. What is soil porosity? **The space between soil particles where air and water can be found**

3. List three ways soil can help you. **Answers will vary, but may include making it possible to grow food, supporting houses and highways, cleaning water, recycling formerly living things**

4. Name three ways you can help soil. **Answers will vary, but might include not compacting it, not pouring chemicals on the ground, planting things or adding mulch so it doesn't wash away.**

5. Match the habitat to the type of soil it is most likely to have:

Mixed forest	Mollisols
Deciduous forest	Alfisols
River bottom	Entisols
Prairie	Inseptisols
Wetland	Histosols

Key: Mixed forest/Inseptisols; Deciduous forest/Alfisols; River bottom/Entisol; Praire/Mollisols; Wetlands/histosols

6. Name two kinds of soil creatures that feed on bacteria. **Nematodes, protozoa**

7. Name three jobs microbes perform in making and maintaining healthy soil. **Answers may vary but might include: breaking down organic materials, making nutrients accessible to plants, capturing the sun's energy, serving as food for other living things, giving soil its texture and fragrance.**

8. Which of these are protozoa?

rhizobia

amoebas

nematodes

ciliates

flagellates

9. Name three ways soil pollution can be harmful. **1. It can kill things that live in the soil. 2. It can make it hard for plants to grow in the soil. 3. It can pollute water we drink or use to water crops.**

10. Which of the following should NOT be used to make compost?

- fallen leaves
- bread crusts
- eggshells
- chicken bones
- cheese
- onion peels

Challenge Question: Using information from the story, approximately how many living creatures might be in the cup of soil your teacher showed you before reading this story? **The story tells us that a billion creatures can live in a single teaspoon of soil. There are 3 teaspoons in a tablespoon and 16 tablespoons in a cup. $1 \text{ billion} \times 3 \times 16 = 48 \text{ billion}$ creatures in a cup of soil.**

Minnesota Comprehensive Assessments Practice Items

"The Soil is Alive!" by Mary Hoff. Published in the September–October 2020 *Minnesota Conservation Volunteer*, or visit www.mndnr.gov/young_naturalists/soil.

Name _____ Date _____

1. Put the soil layers in order, with 1 being the top layer and 5 being the deepest layer.

- subsoil
- decomposing matter
- topsoil
- parent material
- sand and silt

answer: 4 – 1 – 2 – 5 – 3

2. How do rocks and pebbles turn into soil? **Water and roots break them up into tiny bits.**

3. True or false: Insects are animals. **True.**

4. A symbiotic relationship is a relationship in which two kinds of organisms interact in a way that benefits both. What symbiotic relationship does this story describe? **Bacteria called rhizobia share nitrogen with plants, which in turn share sugar with them.**

5. Why is it a good idea to cover bare soil with mulch? **To keep it from washing or blowing away.**

Vocabulary

“The Soil is Alive!” by Mary Hoff. Published in the September–October 2020 *Minnesota Conservation Volunteer*, or visit www.mndnr.gov/young_naturalists/soil.

compaction – squishing

decomposers – living things that turn formerly living things into chemical building blocks other living things can use to grow

erosion – wearing away

inhabitants – creatures that live in a place

microbes – organisms that are too small to be seen without magnification

mulch – a ground covering often made from chopped or shredded plant parts

unsuitable – not good for

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