Young Naturalists

# Teachers Guide

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## "Wild Engineers: Minnesota Animals Shape Their World" Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalists article "Wild Engineers: Minnesota Animals Shape Their World" by Mary Hoff. Published in the November–December 2006 *Minnesota Conservation Volunteer*, or visit www.dnr.state.mn.us/young_naturalists/wild_engineers.


*Young Naturalists teachers guides are provided free of charge to classroom teachers, parents, and students. This guide contains a brief summary of the articles, suggested independent reading levels, word counts, 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 and vocabulary study cards. There is also a practice quiz (with answer key) in Minnesota Comprehensive Assessments format. Materials may be reproduced and/or modified a 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**

Summary "Wild Engineers" is a survey of eight animals, from arachnids to mammals, that modify their habitats to protect themselves from predators, to reproduce, or to obtain food. This article contains many excellent photos that are included in the PDF version available online. (Please note that Young Naturalists are the only *Conservation Volunteer* articles available in PDF format from the Web site.)

| | |
|---|---|
| **Suggested reading levels:** | third through eighth grades |
| **Total words:** | 1,259 |

**Materials:** Paper, poster board, pencils, pens, markers, print resources from your media center, materials suitable for construction of the project described in the extension activities section.

**Preparation time:** One to two hours, not including time for extension activities

**Estimated instructional time:** Two to three 50-minute class periods (not including extensions)

**Minnesota Academic Standards applications:** "Wild Engineers: Minnesota Animals Shape Their World" 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

**Minnesota History and Social Studies**

**II. Minnesota History: Grades 4–8**
- B. Contact and Fur Trade 1600–1810

**V. Geography: Grades 4–8**
- D. Interconnections: The student will describe how humans influence the environment and are in turn influenced by it.

**Science**

**Grade 3**

**IV. Life Science**
- B. Diversity of Organisms
- C. Interdependence of Life

**Grade 4**

**IV. Life Science**
- B. Diversity of Organisms

**Grade 5**

**IV. Life Science**
- E. Biological Populations Change Over Time
- F. Flow of Matter and Energy

**Grade 7**

**IV. Life Science**
- B. Diversity of Organisms
- C. Interdependence of Life
- E. Biological Populations Change Over Time
- F. Flow of Matter and Energy

**Arts**

**Artistic Expression:** Visual Arts

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

## Preview

Survey the article. Ask your students to examine the illustrations. Use the **KWL** strategy (Ogle, 1986) to find out what your students already know (**K**) about how organisms, including humans, change their environments to benefit themselves, what (**W**) they would 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

You may wish to preview the attached list as well as any other words based on knowledge of your students' needs. 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. If students are not familiar with some of the terms, include them in the **W** list. Unfamiliar terms may be added to the **W** list as the article is read. Eventually, they can be moved to the **L** list. You may write vocabulary from the article in green ink, while other ideas are written in black. You may wish to use the study cards found at the end of this guide. Study cards (Hock, Deshler, and Schumaker, 2000), can be applied to any subject area. Cut along the horizontal lines, fold in the middle, and tape or staple. On one side of the card, in large letters, write a key word or phrase from the article that students are expected to know. In smaller letters frame the word or phrase in a question or statement. On the other side of the card, in large letters, write the answer to the question. Finally, in smaller letters, frame the answer in a question or statement. Blanks are provided to allow you or your students to add new words or phrases.

## 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). 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, in small groups, or as an independent activity. 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 also be used as a quiz. Note: Items 1, 4, 6, and 7 and the challenge require analytical thinking.

## Adaptations

Read aloud to special needs students. Abbreviate the study questions or highlight priority items to be completed first—for example, items 1, 2, 4, 7, and 10. If time allows, remaining items may be attempted. 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, in a brief essay, compare and contrast two of the animals' engineering strategies. (2) Students may sketch an animal in its habitat, showing how it changes that habitat to increase its chances for survival. (3) Item 2 may then be shared in poster presentations.

## Extension activities

1. Plan a field trip to your school forest or a nearby state park to observe species in the article. You may contact a park naturalist (www.dnr.state.mn.us/state_parks) for a guided tour.
2. Gather monofilament fishing line, string, glue, twigs, soil and water (for making mud), and newsprint, flour, and water (for making papier-mâché). Ask students to build one of the structures described in the article.
3. Extend assessment item 1 (above) by challenging students to relate one or more of the animal structures to human environmental adaptations that serve the same or similar purposes.
4. Collect some galls, cut in half and examine under a magnifying glass.

## Web resources

**Bald-faced hornets**
www.fcps.edu/StratfordLandingES/Ecology/mpages/bald-faced_hornet.htm

**Eastern mole**
animaldiversity.ummz.umich.edu/site/accounts/information/Scalopus_aquaticus.html

**Bluegill**
www.dnr.state.mn.us/snapshots/fish/bluegill.html

**Argiope**
animaldiversity.ummz.umich.edu/site/accounts/information/Argiope_aurantia.html

**Baltimore oriole**
www.mbr-pwrc.usgs.gov/id/framlst/i5070id.html

**Midge**
weaselhead.org/profile/?s=1892

**Galls**
insects.ummz.lsa.umich.edu/MES/notes/entonotes2.html

**Beaver**
www.dnr.state.mn.us/snapshots/mammals/beaver.html

**Caddisfly**
www.fcps.edu/StratfordLandingES/Ecology/mpages/northern_caddis_fly.htm

Related *Minnesota Conservation Volunteer* articles (see www.dnr.state.mn.us/volunteer/articles) include:

**March–April 2006**
"The Hole Story" (with teachers guide)

**November–December 2000**
"The Curious World of Galls"

**May–June 1996**
"Fish Sense" (with teachers guide)

**January–February 1995**
"What's Making a Racket?"

**July–August 1995**
"Eager Beavers"

**March–April 1994**
"Baby Birds of Minnesota"

**January–February 1993**
"Black Bear Yearbook"

## References

1. Hock, M.F., Deshler, D.D., and Schumaker, J.B. *Strategic Tutoring.* Lawrence, Kan.: Edge Enterprises, 2000.
2. 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.

## Study Questions

"Wild Engineers: Minnesota Animals Shape Their World," by Mary Hoff
*Minnesota Conservation Volunteer*, November–December 2006
www.dnr.state.mn.us/young_naturalists/wild_engineers

Name _____ Period _____ Date _____

1. Explain how bald-faced hornets use spit to build their nests. _____

_____

_____

2. The eastern mole digs two types of tunnels. What are they, and what are they used for? ___

_____

_____

3. How is a mole's body adapted for digging? _____

_____

_____

4. Describe how female and male bluegills cooperate to raise their young. _____

_____

_____

5. All of the steps a garden spider follows to build a web are listed below, but not in the correct order. Number the steps in the right order:

_____ A stabilimentum is woven in the middle of the web.
_____ A single thread catches on a leaf.
_____ A thread is spun down the middle.
_____ The first thread is attached to the plant the spider is on.
_____ Dry threads are spun between the frame and the center.
_____ A frame is spun around the first two threads.
_____ A spiral of sticky threads is spun.
_____ A spiral of dry threads is spun.

6. Why does the spider produce two kinds of threads, dry and sticky? _____ .

_____

_____

7. How are Baltimore oriole nests different from most other birds' nests? _____ .

_____

8. How does the midge larva change the way a willow grows? _____

_____

_____

9. How does the parasitoid wasp outsmart the midge? _____

_____

_____

10. Describe the caddisfly larva's strategy for protecting itself from predators. _____

_____

11. What is good way to identify different species of caddisfly larvae? _____

_____

_____

**Challenge:** Some people destroy beaver dams. Why? _____

_____

_____

## Study Questions Answer Key

"Wild Engineers: Minnesota Animals Shape Their World," by Mary Hoff
*Minnesota Conservation Volunteer*, November–December 2006
www.dnr.state.mn.us/young_naturalists/wild_engineers

1. Explain how bald-faced hornets use spit to build their nests. **Their saliva is like a glue or cement that holds the wood pulp together and also attaches the nest to the tree or other support.**
2. The eastern mole digs two types of tunnels. What are they, and what are they used for? **One is a deep tunnel, used for traveling in safety. The other is a shallow tunnel, used for finding food.**
3. How is a mole's body adapted for digging? **Moles have front feet that face outward for moving soil. Their shoulder muscles are strong for digging. Their noses are pointed for moving soil and their ears and eyes are covered by skin to keep soil out.**
4. Describe how female and male bluegills cooperate to raise their young. **The male builds the nest; the female lays the eggs; the male fertilizes the eggs and stays near to protect them from predators and from being covered by silt.**
5. All of the steps a garden spider follows to build a web are listed below, but not in the correct order. Number the steps in the right order:

   **8** A stabilimentum is woven in the middle of the web.
   **1** A single thread catches on a leaf.
   **3** A thread is spun down the middle.
   **2** The first thread is attached to the plant the spider is on.
   **5** Dry threads are spun between the frame and the center.
   **4** A frame is spun around the first two threads.
   **7** A spiral of sticky threads is spun.
   **6** A spiral of dry threads is spun.

6. Why does the spider produce two kinds of threads, dry and sticky? **The spider travels on the dry threads, while prey insects are caught in the sticky threads.**
7. How are Baltimore oriole nests different from most other birds' nests? **They hang down from the far tips of branches and are shaped like a pouch.**
8. How does the midge larva change the way a willow grows? **It secretes a chemical that causes the leaves to form a cone-shaped growth called a gall.**
9. How does the parasitoid wasp outsmart the midge? **The wasp waits until the gall is formed and lays its eggs near the midge larva. The wasp larva eats the midge larva and uses the gall as a safe place to mature.**
10. Describe the caddisfly larva's strategy for protecting itself from predators. **It produces a silklike material that allows it to attach a protective coat of small stones and sticks.**

11. What is good way to identify different species of caddisfly larvae? **By examining the materials used to make their protective coating.**

**Challenge:** Some people destroy beaver dams. Why? **Sometimes beavers create high water in streams and lakes and damage trees near their ponds.**

## Minnesota Comprehensive Assessments Practice Items

"Wild Engineers: Minnesota Animals Shape Their World," by Mary Hoff
*Minnesota Conservation Volunteer*, November–December 2006
www.dnr.state.mn.us/young_naturalists/wild_engineers

Name _____Period _____Date_____

1. _____ use small sticks and stones to build a case around their bodies.
   A. Beavers
   B. Caddisfly larvae
   C. Wasps
   D. *Rhabdophaga strobiloides*

2. Beavers build dams in _____ or _____.
   A standing water or cornfields
   B streams or woods
   C. standing water or streams
   D. wetlands or hillsides

3. A gall is a _____.
   A. protective shelter for an insect larvae
   B. part of an insect's body
   C. lump on a plant stem
   D. A and C

4. A bluegill nest might contain _____ eggs.
   A. 100 or more
   B. 1,000 or more
   C. 10,000 or more
   D. 100,000 or more

5. Orioles line their nests with _____.
   A. grass
   B. feathers
   C. hair
   D. all of the above

## Minnesota Comprehensive Assessments Practice Items Answer Key

"Wild Engineers: Minnesota Animals Shape Their World," by Mary Hoff
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1. **B. Caddisfly larvae** use small sticks and stones to build a case around their bodies.
2. Beavers build dams in **C. standing water or streams.**
3. A gall is a **D. A protective shelter for an insect larvae and C lump on a plant stem**
4. A bluegill nest might contain **C. 10,000 or more** eggs.
5. Orioles line their nests with **D. all of the above**.

## Vocabulary

"Wild Engineers: Minnesota Animals Shape Their World," by Mary Hoff
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| | |
|---|---|
| **habitat** | natural conditions and environment |
| **pulp** | crushed wood |
| **miniature** | smaller version |
| **larva (larvae)** | immature, wormlike form of many insects |
| **excavate** | dig |
| **predator** | animal that eats other animals |
| **fertilize** | to unite sperm and egg |
| **silt** | fine soil particles |
| **silk** | fine fibers that spiders secrete to make their webs |
| **spiral** | to move outward in gradually increasing circles |
| **flexible** | easily bent without damage |
| **pupa** | insect stage between larva and adult |
| **salivary gland** | a body part that produces saliva (spit) |

## Vocabulary Study Cards

"Wild Engineers: Minnesota Animals Shape Their World," by Mary Hoff
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Cut along the horizontal lines, fold in the middle and tape or staple. Blanks are provided to allow you or your students to add new words or phrases.

| | |
|---|---|
| An object is **miniature** when it is a | A **very small copy of a larger object** is called a |
| What does **habitat** mean? | A **place where a plant or animal lives** is its |
| **Wood pulp** is | **Ground wood fibers** are called |

| | |
|---|---|
| A **larva** is | An **immature, wormlike stage of insect development** is called a |
| To **excavate** is to | To **dig** is to |
| A **predator** is | An **animal that eats other animals** is a |
| To **fertilize** an egg is to | To **combine an egg with a sperm cell** is to |

| | |
|---|---|
| What is **silt**? | **Fine soil particles** are called |
| **Silk** is | A **fine thread produced by spiders and insects** is |
| When a line is **spiral** it | When a line **follows a circular pattern inward or outward** it is a |
| What are **flexible** branches? | **Branches that can bend without breaking** are |

What is a
**pupa**

An
**insect between larvae and adult stages**
is called a

The
**salivary gland**
produces

**Saliva (spit)**
is produced by the