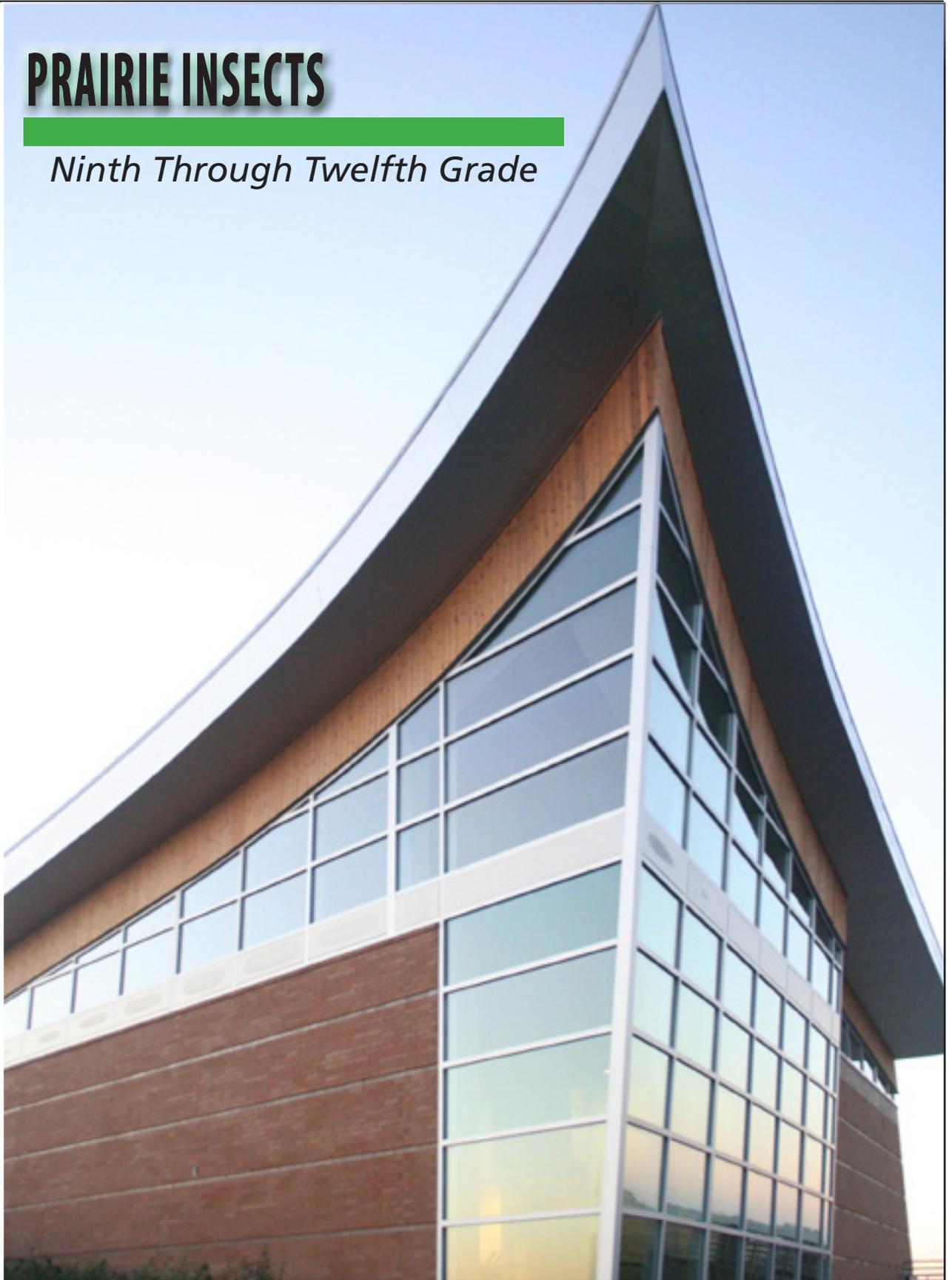


Free Land was the Cry!

PRAIRIE INSECTS

Ninth Through Twelfth Grade



Homestead

National Park Service
U.S. Department of the Interior

Homestead National Monument
of America, Nebraska



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Some of the ideas in this lesson may have been adapted from earlier, unacknowledged sources without our knowledge. If the reader believes this to be the case, please let us know, and appropriate corrections will be made. Thank you.

PROGRAM DESCRIPTION



‘The Monument’s natural resources are managed in such a way as to maintain a heterogeneous landscape composed of a mosaic of high quality remnant and restored tallgrass prairie, lowland bur oak forest and associated ecotones, as well as prairie streams and their hydrologic processes; that reflect the value of the site as a homestead, represents as accurately as possible the environment encountered by early settlers, and preserves native biodiversity.’

*Desired Future Condition of the Natural Resources of
Homestead National Monument of America*

Homestead National Monument of America’s tallgrass prairie is managed so that visitors can experience an environment similar to the one experienced by homesteaders. An important element in the biodiversity of the tallgrass prairie is insects.

The homesteaders encountered insects often in their everyday life. Ants and grain beetles could infest their grain and staple food supplies. Wasps could sting vicious-

ly and if one was allergic to their sting, death would follow as they had no antidotes to the venom. Fleas carried deadly diseases such as plagues. Bed bugs, lice, chiggers and mosquitos also made life uncomfortable.

Homesteaders often had to treat animals for the New World Screwworm, a type of blow fly that would infest wounds of living animals, including humans. Clothes moths would eat holes in wool and cotton clothing.

Butterflies, although not problematic, were prevalent in the prairies as well. Even though insects were a challenge for the homesteaders they are important to maintaining a healthy prairie.

Insects perform a vast number of important functions. They aerate the soil, pollinate blossoms, and control insect and plant pests; they also decompose dead materials, thereby reintroducing nutrients into the soil. Burrowing bugs such as ants and beetles dig tunnels that provide channels for water, benefiting plants. Bees play a major role in pollinating fruit trees and flower blossoms. Gardeners love the big-eyed bug and praying mantis because they control the size of certain insect populations, such as aphids and caterpillars, which feed on new plant growth. Finally, all insects fertilize the soil with the nutrients from their droppings.

CURRICULUM OBJECTIVES

- Students will compare the smell of a burning beeswax candle to a non-beeswax candle.
- Students will be able to name three types of products made from beeswax.
- Students will observe and differentiate the tastes of different types of honey.
- Students will compare and contrast the types of bees found in Nebraska Prairies.
- Students will research the biology and life cycle of social insects.
- Students will discover factors that affect the life of honeybees.

NATIONAL STANDARDS

NS.9-12.1 SCIENCE AS INQUIRY

As a result of their activities in grades 9-12, all students should develop

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry.

NS.9-12.3 LIFE SCIENCE

As a result of their activities in grades 9-12, all students should develop understanding of

- The cell
- Molecular basis of heredity
- Biological evolution
- Interdependence of organisms
- Matter, energy, and organization in living systems
- Behavior of organisms.

SPECIAL ICONS		<i>Enrichment Activities</i>		<i>Science</i>		<i>Language Arts</i>
	Indicates a reproducible handout is included		Indicates an additional math lesson		Indicates an additional music or art activity	
		Indicates advanced lessons		Indicates an additional science activity		Indicates an additional language arts lesson

Pre-Visit Activity #1 (suggested)

BEES



Bees were an important resource for the early homesteaders. Besides their value as pollinators for crops grown, they also provided honey used for sweetening foods and beeswax for making candles to light the early sod houses and cabins. Early homesteaders relied on finding bee trees for their supply of honey and beeswax.

Bees are insects that are characterized by three body parts (head, thorax, and abdomen), six legs attached to the thorax, an exoskeleton, bulging compound eyes, and antennae. Bees have a waist called a pedicel between the base of the abdomen and the thorax. A reasonably strong argument can be made that insects are the dominant life form on earth. Keep in mind that the number of insect species is more than the total number of all other organism species on earth! In fact, beetle species outnumber all the plant species in the world. Insects are found everywhere in the world except

for the deep ocean. Although they have a short life span, their remarkable reproductive capacity gives them a tremendous adaptive advantage.

Insects were the first earth creatures that were capable of flight. This, too, is a great adaptive advantage that allows them to escape their enemies, to search large areas for food, water, or mates, and to colonize new areas. Bees have two



BEES

Pre-Visit Activity #1 (suggested)

pairs of wings that are laced with a distinct vein pattern that is often used to identify the species.

The majority of insects lay eggs and the embryo develops outside of the mother's body in a series of changes known as metamorphosis. The life cycle of a bee is called complete metamorphosis consisting of four distinct stages: egg, larva, pupa and adult. The larva hatches from the egg. A larva eats and grows and is wormlike in appearance. A larva has a series of simple eyes on its head, chewing mouthparts, a pair of very short antennae, and are legless. The larva feeds on pollen or nectar. The larva turns into a pupa and then into the adult.

Bees are social insects with the offspring and parents often living in the same nest. A colony is composed of 40,000 to 100,000 bees that work together as a unit and are loyal to one queen. There are three types of adult bees: workers, drones, and the queen. Each is indispensable in the survival of the colony. Workers are sterile females. They begin their life by feeding the larvae and spend the first half of their life in the hive. At about ten days old, a worker bee begins taking short orientation flights around the hive. Next, they work at comb building and fanning to cool the hive in hot weather. Next, the worker bee will guard the hive and kill any intruders by stinging them. In the process of killing the intruder, the worker bee leaves behind part of its abdomen and soon dies. Other guard bees then become a field bee collecting pollen and nectar to bring back to the hive. These bees have intricate dances used to tell the other bees the location of food.

The queen is larger than the other two types of bees. She has a long abdomen that becomes more

elongated as she lays eggs. She lays eggs day after day, week after week often laying 2,000 eggs per day. A queen may live up to five years, but is a good layer for only two years. The drone is about the same size as the queen, but has a wider abdomen covered at the end by fine hairs. Unlike the queen and the workers, the drone's eyes lie adjacent to one another on the top of his head giving him a distinctive look. His sole purpose is to mate with the queen.



Primitive people were not bee-keepers; rather, they were bee-hunters. Finding out that the smoke from a torch quieted the bees long enough to take the honey was important as it made the acquisition of honey much easier. As people began to live a more stationary life, a store of

bee trees, caves, and logs were used to encourage bees to stay in one place. Later, they cut holes in trees, dead stumps, and logs to encourage swarms.

The log-type hive persisted for many centuries. American pioneers kept bees in blue gum logs, a type of tree plentiful in the Blue Ridge Mountains of North Carolina. Before 1851, bees were kept in boxes or straw skeps (imagine an upside-down woven basket). The bees attached their combs to the sides of the hive and an interior inspection was not possible. The only way to collect the honey and wax was to kill the bees or drive them away from their nest.

In 1851, the Reverend Lorenzo Lorraine Langstroth of Massachusetts developed the removable hanging frames in the wooden hive. This removable frame revolutionized beekeeping as it enabled beekeepers to remove the honey without destroying the bees. Because of his invention, Langstroth is known as the father of modern beekeeping.

**Pre-Visit
Activity #2
(suggested)**

HONEY AND BEESWAX



Theme

Homesteaders depended on bees to provide honey and beeswax.

Materials

Beeswax candles

Non-beeswax candles

Samples of items with beeswax listed as an ingredient: crayons, lipstick, gum

Samples of different flavored honey sticks

Skills

Comparison, contrasting, observation, prediction, and research

Methods

1. Explain that because beeswax burns slowly and gives off a pleasant smell, it makes good candles. Bring in a sample of beeswax candle and smell it in its natural state. Then, using caution and a safe distance from the students, light the candle. Allow it to burn awhile. Is the scent noticed: Is it different or the same as the scent of the candle before it was lit? Compare with a non-scented non-beeswax candle.
2. Look for labels on items that contain beeswax. Read the fine print on products such as chewing gum, crayons, adhesives, polishes, lipstick, and other cosmetics. Bring in samples for display. Explain why beeswax is an effective material for these products. Have students investigate labels in stores and record the name of the products they find.
3. Have a honey party. Bring in samples of honey. What different flavors are there? Farmer's markets are sources of honey sticks (similar to straws) that come in different flavors.

SPECIES OF BEES

Pre-Visit Activity #3 (suggested)

Theme

The prairies of Nebraska were the home of many different species of bees that have different habitats and nesting habits.

Materials

Books and photographs of several varieties of bees

Bee chart

Social insect webquest

Skills

Comparison, contrasting, observation, prediction, and research

Methods

1. Arrange for a visit to an outdoor park with flowers or prairie for students to observe bees.
2. Contact a local beekeeper to tell students how bees live and move about.
3. Read independently about different bees. Make a class list of the different kinds of bees read about. Which bee makes enough honey and beeswax to be used by people?
4. Reproduce the Bee Chart. Complete the chart as a class, library, or homework activity.

Bee Chart

Type of Bee	Hive or Nest Habits	Solitary or Social Bee	Stinging Habits
Honeybees			
Bumblebees			
Leafcutting Bees			
Mason Bees			
Burrowing Bees			



RANGER-LED EXPERIENCE

Insect Scavenger Hunt

Main idea: More insects are found on earth than any other type of animal. Students will have the opportunity to explore and collect insects from various habitats.

Objective:

1. To learn about the habitats of insects and other arthropods
2. To recognize insect roles in the environment
3. To explore insect diversity



Materials: insect nets, plastic bags or bottles for specimens

Procedure: See how many examples for each of the listed items you can find.

Item	Habitat	Possible Points	Points Received
An insect home		5	
A predatory insect		2	
An insect that uses camouflage		5	
An arachnid		2	
A crustacean		2	
A millipede		2	
A centipede		2	
An insect that lives in a society		2	
A decomposer insect		3	
An insect without wings		3	
An insect with 2 wings		2	
An insect with 4 wings		2	
3 different beetles		5	
An insect pollinator		3	
An insect belonging to the order Orthoptera		2	
An insect belonging to the order Hemiptera		2	
An insect belonging to the order Lepidoptera		2	
An insect belonging to the order Diptera		2	
An insect belonging to the order Hymenoptera		2	
An immature insect		3	
An insect egg		5	

Total: 58 _____

RANGER-LED EXPERIENCE



Homestead National Monument of America is proud to be a pioneer in distance learning technology.

Contact the Education Coordinator at (402) 223-3514 to schedule your virtual field trip on Prairie Insects.

**Post-Visit
Activity #1
(suggested)**

SOCIAL LIFE OF BEES



Activities

Teacher Component: Prepare copies of the Social Life of Bees Webquest.

Student Components: Use an Internet web browser to locate the recommended websites and answer the questions.

Turn in the assignment at the end of the period.

Recommended Websites

Bees: <http://www.saburchill.com/ans02/chapters/chap004.html>

Collective Intelligence in Social Insects: <http://ai-depot.com/Essay/SocialInsects.html> (must type exactly as written)

Insights into Social Insects: <http://www.nature.com/nature/journal/v443/n7114/full/nature05260.html>
(only the first 5-6 pages are used)

SOCIAL LIFE OF BEES

Post-Visit Activity #1 (suggested)

Time required to complete webquest: 1-2 45-minute blocks.

Time required to complete project: Variable depending on project.



Directions

Before starting the questions, navigate to the recommended websites and browse through the information. Take note of the information given and take a few minutes to explore the sites. This will give you an understanding of how the websites are organized and what type of information is found at each one.

If you use a different website than those listed or include a picture, be sure to parenthetically cite the source and include a reference cited page.

Using the information found on the websites, open a new word processing document and answer the following questions. Use complete sentences with good grammar.

1. Define “social insects”.
2. Define what a “caste” is.
3. What are the characteristics of eusocial behavior?
4. List and describe the social castes of honeybees.
5. Describe the life of a typical worker bee.
6. Describe how male and female bees originate in the hive.
7. Define “homeostasis” and describe examples of how insects maintain this condition.
8. Describe characteristics of the queen honeybee.

CHARACTER EDUCATION

CARING

Caring students help, give, love, and are kind. You can tell a person is caring by what she or he does. They are caretakers of people, pets, plants, possessions and our planet, Earth.

5 Minute Focus

- Why care about insects?
- Give examples of good insects.
- Give examples of bad insects.
- What benefits do people get from insects?
- What are some ways to care about insects?

ADDITIONAL RESOURCES

Click here to see amazing, close-up images of bug bodies: <http://www5.pbrc.hawaii.edu/microangela/>

Explore Life as a Bug at this site: <http://museumvictoria.com.au/bugs/life/index.aspx>

Read about how insects grow: <http://exhibits.pacsci.org/insects/metamorphosis.html>

Explore an interactive beehive here: <http://www.pbs.org/wgbh/nova/bees/hive.html>

Find out more about the life of a honey bee: <http://www.sandiegozoo.org/animalbytes/t-bee.html>

Interactive White Board

Find out the meaning of bee dances: <http://www.pbs.org/wgbh/nova/bees/dances.html>

Bee Chart

Type of Bee	Hive or Nest Habits	Solitary or Social Bee	Stinging Habits
Honeybees			
Bumblebees			
Leafcutting Bees			
Mason Bees			
Burrowing Bees			

Social Life of Bees

Webquest for students in Grades 9-12

Time required to complete web quest: 1-2 45min blocks.

Time required to complete project: Variable depending on project.

Activities

Teacher Component: Prepare copies of the Social Life of Bees Webquest.

Student Components: Use an Internet web browser to locate the recommended websites and answer questions.

Turn in the assignment at the end of the period.

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6. Describe how male and female bees originate in the hive.
7. Define “homeostasis” and describe examples of how insects maintain this condition.
8. Describe characteristics of the queen honeybee.

Social Life of Bees

(Key)

Using the information found on the websites, answer the following questions.

1. Define social insect.

Insects that live cooperatively in colonies and exhibit a division of labor among distinct castes. Ex. termites, ants, bees, some wasps.

2. Define what a caste is.

A specialized segment of the population of social insects, castes have different functions within the society and sometimes different morphologies. Castes have distinct divisions of labor.

3. What are the characteristics of eusocial behavior?

Social systems characterized by parental care of young, overlap of generations, and reproductive division of labor. True sociality.

4. List and describe the social castes of honeybees.

- **Reproductive Castes-** queen and drone
 - Queen- produces eggs to maintain the colony.
 - Drones- mate with new queens.
- **Worker Castes-** sister, all daughters of the queen
 - Care for the eggs, larvae, queen and drones.
 - Maintain and defend the hive and forage for food.

5. Describe the life of a typical worker bee.

Days	Worker Bee's Activities
1 and 2	Cleaning the honeycomb cells and keeping the eggs and the larvae warm.
3 to 6	Feeding the older larvae with beebread.
7 to 11	Feeding the younger larvae with royal jelly.
12 to 17	Making beeswax and building honeycombs; moving food around the hive.
18 to 21	Guarding and ventilating the entrance to the hive.
22 to 34	Visiting flowers to collect pollen and nectar.
35 to 45	End of the life of a worker bee.

6. Describe how male and female bees originate in the hive.

- Queen lays all the eggs and regulates sex of offspring (parthenogenesis).
 - Unfertilized eggs -> males
 - Fertilized eggs -> females
- All members of the hive are the queen's progeny.
- The queen's pheromones identify hive members.

The Worker Bees

- Workers determine type of egg laid by the queen.
 - Large cells receive unfertilized eggs that develop into males – males haploid.
 - Smaller cells receive fertilized eggs that develop into females – females diploid.
- Workers determine whether a female egg develops into a reproductive or worker bee.
 - Workers receive royal jelly only their first three days.
 - Queens receive royal jelly throughout the larval stage.

7. Define homeostasis and describe examples of how insects maintain this condition.

Some social insects are able to maintain steady state conditions in their colonies or nests, e.g. in temperature and humidity. This is called **homeostasis** and is essential for colony health.

Examples: Honeybees

- Ventilate their hives – if too hot, wax melts.
- Cluster to stay warm in the winter – if too cold, individuals die.

8. Describe characteristics of the queen honeybee.

Queens, typically one per colony, have ten times the lifespan of workers, typically lay up to 2,000 eggs per day for 1 to 2 years, and store sperm for years without losing viability.

Name _____

Insect Scavenger Hunt

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An insect that lives in a society		2	
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An insect belonging to the order Diptera		2	
An insect belonging to the order Hymenoptera		2	
An immature insect		3	
An insect egg		5	

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