What's Bugging You?

Grades 4-6

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Agriculture In The Classroom

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California Foundation for Agriculture in the Classroom

Vision: An appreciation of agriculture by all.

Mission: To increase awareness and understanding of agriculture among California's educators and students.

California Foundation For
Agriculture In The Classroom

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California Foundation For Agriculture In The Classroom

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The California Foundation for Agriculture in the Classroom is dedicated to fostering a greater public knowledge of the agricultural industry. The Foundation works with K-12 teachers, community leaders, media representatives, and government executives to enhance education using agricultural examples.

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The California Farm Bureau Federation actively represents, protects, and advances the social, economic, and educational interests of the farmers in California.

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Introduction

Agriculture is an important industry in the United States, especially in California. As more rural areas become urbanized and more challenges exist to maintain and improve the quality of the planet and feed the people of the world, it is extremely important to educate students about agriculture. Pest management is a current issue in society today. Advances in pest management strategies have encouraged an Integrated Pest Management approach (IPM). This method of pest management continues to benefit the agricultural industry and the environment. However, it is crucial that research and communication continue so the earth's viability and sustainability are reviewed, evaluated, and maintained.

Throughout this interdisciplinary unit, *What's Bugging You?*, students participate in activities that include higher-order thinking skills, creative thinking, role-playing, and problem solving. Care is given to provide variations and extensions to make the unit appropriate for students who have a variety of skills, ability levels, and English language proficiencies. Scientific principles on pest management are provided in a format that encourages students to think critically, creatively, and freely about the complexity of ecosystems and pest management strategies.

This unit can be used to teach or reinforce specific subject matter Content Standards for California Public Schools. The standards which apply to each lesson are listed by grade level, subject matter, and number, on the sidebars of each lesson. A content standard matrix for the entire unit, with the specific standards described, is located on pages 51-58.

What the future holds for agriculture will determine the quality of life for all . . .

- *farmers and ranchers*
- *suppliers*
- *food processors*
- *wholesalers*
- *retailers*
- *consumers!*

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Unit Overview

Unit Length

7-10 forty-five minute sessions.

Objectives

The students will:

- Create a useful definition for the word pest.
- Examine how pests affect other living organisms and the environment.
- Construct an insect observation chamber.
- Examine live insects.
- Through reading, learn about specific agricultural pests and appreciate the complexity involved in managing these organisms.
- Write a poem about a pest.
- Create a hypothetical pest.
- Understand that all living organisms require air, food, water, and shelter.
- Explore how an organism can be considered a pest in some situations and beneficial or harmless in others.

Brief Description

Through a variety of activities, students reinforce their skills of reading, writing, designing, investigating, and problem-solving while learning about a current issue—pest management. The students develop a definition for the word "pest," learn about agricultural pests in a cooperative reading setting, observe insects in student-made insect observation chambers, learn about the lifecycles of certain pests, and create individual and class poems. In a concluding activity, students create an imaginary pest and discuss its hypothetical habitat.

Curriculum Content Standards for California Public Schools

A concerted effort to improve student achievement in all academic areas has impacted education throughout California. The California Foundation for Agriculture in the Classroom provides educators with numerous resource materials and lessons that can be used to teach and reinforce the Curriculum Content Standards for California Public Schools. One goal of education is to encourage students to think for themselves, ask questions, and learn problem-solving skills while learning the specific content needed to better understand the world in which they live.

This unit, *What's Bugging You?*, includes lessons that teach or reinforce many of the educational content standards for grades four through six. It can be used as a self-contained unit, to enhance themes and lessons already in use, or provide technical information about pest management in agriculture.

The specific subject matter content standards covered in the lessons are listed on the sidebars of each lesson. A matrix showing how the entire unit is aligned with the Curriculum Content Standards for California Public Schools can be found on pages 51-58.

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Unit Overview

Key Vocabulary

Appropriate vocabulary is discussed in each lesson. A glossary of terms is located on pages 59-62.

abdomen
aphid
beneficial
biodegradable
biological control
bug
chemical
control
disease
ecosystem
entomology
environment
eradicate
fungicide
fungus
Glassy-winged sharpshooter
habitat
harmful
head
herbicide
host
insect
insecticidal soap
insecticide
Integrated Pest Management
larva
lygus bug
manage
Mediterranean fruit fly
mite
natural enemies
nymph
organism
parasite
pathogen
pest
pest management
pesticide
phermone

Evaluation

This unit incorporates many activities and questions that can be included in student portfolios or used as independent assessment tools. The concluding activity, A New Pest is Discovered!, requires students to think about what they have learned and to express their knowledge in creatively developed models and oral presentations. Other evaluation factors may include active participation in class discussions and activities, and practice towards mastering a specific content standard.

Visual Display Ideas

- Develop a bulletin board depicting organisms that are potential pests to a specific crop or livestock.
- Using a large Venn diagram, have students write names of organisms in the appropriate section of the diagram—pest, beneficial, both.
- Display photographs or student drawings of insects, emphasizing similarities and differences.
- Create a display of plants and distinguish between native and invasive species.
- Create life cycle diagrams of pests, showing which stages are harmful and which stages are harmless or beneficial.
- Have students illustrate the poems they create in the Pest Poetry activity. Display the illustrations and poems.
- Post the block letters P, E, S, and T. Have the students research pests whose names begin with one of the letters. Post the pest names and descriptions under the appropriate letters.
- Create a mural of an agricultural area. Have students make three-dimensional figures of plants, animals, and resources needed to create and maintain a balanced ecosystem.

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Unit Overview

Key Vocabulary
(continued)

Pierce's disease
predator
proboscis
pupa
Red Imported Fire Ant
rodent
rodenticide
shelter
slug
snail
spider
spider mite
survival
thorax
toxic
trap
weed

Before You Begin

1. Skim over the entire unit. Make appropriate changes to the lessons and student worksheets to meet the needs of your students and teaching style.

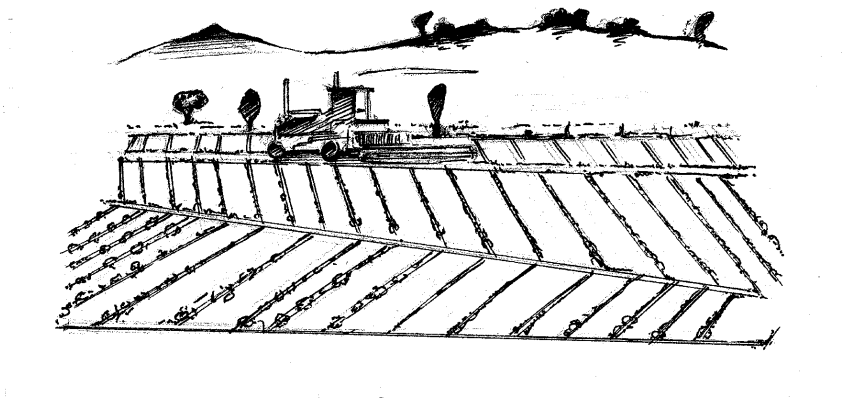
2. Read the *Answers to Commonly Asked Questions* on pages 37-41.

3. Arrange for classroom visits from people involved in pest management—farmers, homeowners, pest control advisors, scientific researchers, agricultural commissioners, and beneficial insect suppliers. Refer to the *Teacher Resources and References* section of this unit for a list of organizations that may have resource people who visit classrooms.

4. Consider an optional field trip to a farm, ranch, or food processing plant. As part of your visit, have the guide discuss the variety of pest management strategies used in their operations.

5. Several activities require supplies that should be gathered over time. Examples include school milk cartons, screen from old screen doors, toilet paper rolls, and other recyclable items. Review the lessons and begin gathering the necessary items.

6. Pest management issues are often in the current news. Begin saving appropriate news articles for discussion with your students. The California Farm Bureau Federation (www.cfbf.com) and California Department of Food and Agriculture (www.cdfa.ca.org) web sites have general information on current agricultural pests.



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What a Pest!

Purpose

The purpose of this activity is to develop an understanding of what pests are and to realize how they affect the lives of people.

Time

One or two 45-minute sessions

Materials

- "Pest Scenarios" *(1 copy),* page 10
- Scissors *(1 pair)*
- Role-play props *(optional)*

Background Information

In this activity, your students will develop a definition for the word "pest." *The Oxford American Dictionary* defines a pest as "a troublesome or annoying thing" or "an organism that is destructive to another organism." The United States Environmental Protection Agency (EPA) defines an agricultural pest as "an unwanted organism; a living thing that competes with people for food and fiber, attacks people or livestock directly, or annoys or otherwise affects aesthetic human values." Your students should develop a definition that is meaningful to them.

Living organisms may be pests at certain times or in certain places, but harmless or beneficial in other situations. Discuss this fact as students complete their role-plays. Also discuss that our society can determine which living organisms are pests. An example of this is that insects or fungi that cause visual, but not nutritional, defects in fruits and vegetables are often controlled because the public currently prefers eye-appealing fruit.

Procedure

1. Perform a focus activity with your students to determine what they already know about pests and what they want to learn about pests. Some possible activities include:

    - A five-minute writing assignment answering the question, "What is a pest?"
    - A class brainstorm answering the questions, "What do we already know about pests?" and "What do we want to learn about pests?"
    - Reading the story or watching the video of *The Tale of Peter Rabbit* or *The Tale of Benjamin Bunny* by Beatrix Potter and then discussing the pests in the story—Peter Rabbit? Mr. MacGregor?

2. Place students into groups of four to six.

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What a Pest!

Content Standards

Grade 4

Science
- Life Sciences • 2b, 3, 3a
- Investigation and Experimentation • 6c

Reading/Language Arts
- Writing • 1.0, 1.3
- Written and Oral Language Conventions • 1.0, 1.1
- Listening and Speaking 1.2, 1.5, 1.6, 1.7, 1.8, 1.9

Grade 5

Science
- Investigation and Experimentation • 6a

Reading/Language Arts
- Writing • 1.0
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.3, 1.4, 1.5, 1.6

Grade 6

Science
- Ecology • 5c, 5d

Reading/Language Arts
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.1, 1.4, 1.5, 1.7

3. Have each group brainstorm and select a possible pest role-play or assign a role-play from one of the scenarios on page 10.

4. Have each group create a role-play of their scenario. Encourage little or no talking by the actors. The group should show the following in their role-play:

   - The pest that is causing the problem.
   - The damage or problem the pest causes.
   - How others try to get rid of the pest.
   - How the organism can be beneficial or harmless.

5. Have the students practice their role-play for 3-5 minutes and then present their role-play to the class. They are *not* to tell the audience the name of the pest. At the end of each presentation, have the audience make guesses as to the name of the pest.

6. After all of the presentations, develop a definition for the word "pest." Discuss other definitions as mentioned in the background information.

7. Write the class definition for the word "pest" on sentence strips or tag board and post it on the wall in a prominent place where all students can refer to it.

Variations

- Describe a pest, without stating its name, and have the students guess what the pest is.
- Complete a chart similar to the one below.

Pest Name	Problem	How Pest Is Controlled	Beneficial or Harmless Attributes

- Make props available for the role-plays, such as hats, plants, and stuffed animals.

- Rather than role-plays, use the scenarios as problem situations where students create solutions to the problems.

Extensions

- Have actual examples of pests for students to observe, such as mold on bread or aphids on roses.

- Go on a pest hunt around the school grounds. Create a technical class journal of animal pests such as mosquitoes and plant pests such as weeds.

- Observe insects such as bees pollinating flowers. Discuss how this particular insect is sometimes beneficial (pollinating) and sometimes harmful (stinging people).

- Using computers with CD-ROMs or the Internet, research information on specific pests.

Pest Scenarios

Instructions: Cut on line and place in a container. Have each student group randomly choose a pest scenario and role-play the situation without using words, or create a solution to the problem.

A younger brother disturbs an older sister while she is studying.	Fleas have found a home on your dog and have infested your yard and home. You are beginning to get itchy flea bites.
You are playing soccer outside in the grass. Mosquitoes keep biting your ankles.	You are an almond farmer. It is late summer and the squirrels and crows are eating your new crop of almonds.
Aphids (little insects) are sucking the liquid from the leaves and buds of your beautiful rose bushes.	You are having a picnic at the park. The ants and flies have found their way to your picnic!
You have weeds growing in your newly planted vegetable patch.	Coyotes are entering your sheep ranch. They are killing and eating some of your lambs.
Deer have invaded your home garden. They just devoured your strawberry patch.	The baby lettuce plants in your school garden are being eaten by slugs.

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Quit Pestering Us!

Purpose

The purpose of this activity is for students to understand how farmers and homeowners control pests, as well as learn about issues associated with pest management.

Time

Student Activities 1 and 2
One hour

Student Activity 3
One 50-minute session

Student Activity 4
One or two 50-minute sessions

Materials

For the class:

- Flyers/brochures from your county Agricultural Commissioner's Office that describe potential pests of which your community should be aware.
- Insect and spider reference books (see *Related Literature* section on pages 48-49).
- Pest trap examples such as mouse traps, fly traps, cockroach traps, opossum traps, and traps obtained from the county Agricultural Commissioner's Office.

Background Information

Pest management is an important component of agricultural production and healthy living situations in the home. In this activity, your students will learn about certain home and agricultural pests and how they are controlled. Prior to this activity, review the *Answers to Commonly Asked Questions* on pages 37-41 for other pest management examples.

Procedure

Activity 1: Pick a Fruit

1. Determine the number of students in your class. Place one apple for each of your students in a box or basket. Make sure the apples have a variety of appearances—bruised, discolored, unusually shaped, shiny, large, small, etc.
2. Have each student choose an apple.
3. Have the students explain why they chose the apples they did. Was it because of size? Appearance? Potential taste?
4. Discuss how people influence what type of food the agricultural community produces. Emphasize that public opinion does impact agricultural production. What is important—nutritional value? Food that is safe to eat? Appearance? Price?

Activity 2: Pest Discussion

Have a class discussion concerning the need for people to control pests. Be sure to discuss the need for farmers to control pests as well as the need for homeowners to control pests. Some key discussion points may include:

- Why people find it necessary to control pests.
- What would happen if certain pests were not controlled by humans.
- How weather affects pest incidence or crop susceptibility (heat, frost, flooding, etc.).

Quit Pestering Us!

Materials *(continued)*

For each of six groups:

- Butcher paper or chart paper.
- Copies of pest management reading – one set per group (pp. 15-26).
- Markers

For each student:

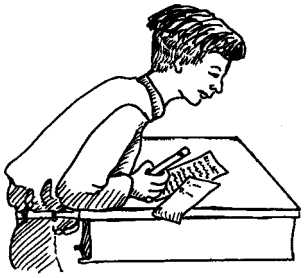
- Apple
- Insect bait, such as fruit, flowers, or meat.
- *Making an Insect Observation Chamber* instructions (p. 27).
- Masking Tape
- School-sized milk carton
- Scissors
- Screen (7" x 7")
- String (20")
- Supplies needed for student designed insect traps *(optional)*

- How changes, such as urbanization, in an ecosystem impact the need to control pests.
- What would happen if one pest were completely eliminated? Is it important to keep a minimal number of every pest?

Activity 3: Pest Management Readings

Divide the students into six groups. Distribute a different pest management reading to each group. Have students follow the procedure below or create a lesson of your own.

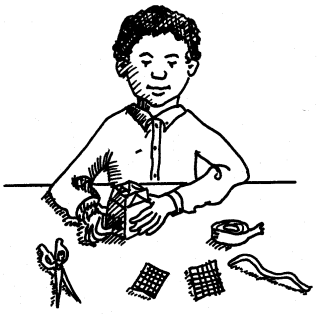
1. Individually, quietly read the assigned information sheet.
2. Orally, re-read the information sheet as a group.
3. In groups, determine at least five interesting facts you learned about the pest.
4. Write down and/or illustrate the facts on butcher paper.



5. Finally, have the students present what they learned to the class.

Activity 4: Insect Observation Chambers

1. Show students different traps that are used in agriculture to analyze what pests are in the orchards, fields, and homes. Do not forget to include a mouse trap in your collection. Discuss the functions of the traps. They are used to identify pests, determine pest populations, and/or reduce the number of a particular pest. *(Many sample traps are available from your county's Agricultural Commissioner's Office.)*



2. Have the students design and construct an insect observation chamber they will hang or place in their yard and examine for insects. One possible insect observation chamber is described on page 27. Some possible discussions prior to this lesson may include:

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Content Standards

Grade 4

Science
- Life Sciences • 2b, 3a, 3b, 3c
- Investigation and Experimentation • 6b

Reading/Language Arts
- Reading • 1.0, 1.1, 2.0, 2.2, 2.6
- Writing • 1.0, 2.4
- Written and Oral Language Conventions • 1.0, 1.1
- Listening and Speaking 1.0, 1.1, 1.2, 1.5, 1.6, 2.3

Grade 5

Science
- Earth Sciences • 4c

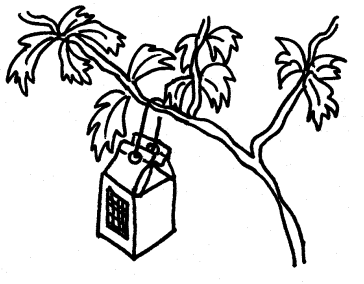
Reading/Language Arts
- Reading • 1.0, 1.1, 2.3, 2.4
- Writing • 1.0
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.0, 1.1. 1.3, 1.4, 1.5, 2.2

Grade 6

Science
- Ecology • 5, 5c, 5d, 5e

Reading/Language Arts
- Reading • 1.0, 1.4, 2.0, 2.2, 2.3, 2.4
- Writing • 1.0, 1.3
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.0, 1.6, 1.7, 2.5

- Insect diet.
- Insect anatomy, including mouth parts and their functions.
- Pheromones and their function in mate attraction.
- Purposes for insect traps.
- Trap designs that prevent insects from leaving.



3. Have the students examine the trap during morning and evening hours, if possible. Are all of the captured insects considered pests? Are there other things besides "bugs" that are considered pests?

4. Have your students report back on the types of insects and spiders they caught. You should have insect identification books available. *The Audubon Society Field Guide to North American Insects and Spiders* is one suggested reference.

5. Discuss how the insects can be beneficial or bothersome. Call the discussion "Trap News!"

Variations

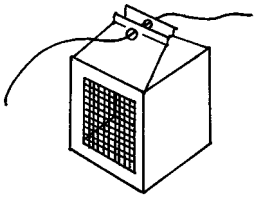
- Have all students read each of the reading assignments and write their comments about each reading in a student-made journal.

- Create a scenario which requires the students to manage a particular pest. Have them design and create a pest management strategy for their pest.

Extensions

- Have the students plant radish and grass seeds together and observe the competition between a crop (radishes) and a weed (grass).

- Have the students design and build their own fly trap that will capture and/or kill household flies.



- Invite a representative from your local Agricultural Commissioner's office or county Farm Bureau to talk to your class about pest management strategies used in agriculture.

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Quit Pestering Us!

Content Standards

(continued)

History-Social Science

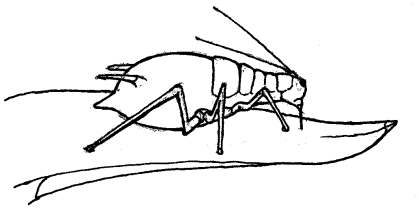
World History and Geography: Ancient Civilizations • 6.1.3

- Invite a Plant Doctor to speak to your class. A Plant Doctor is a person who identifies crop problems and recommends pest management strategies. See *Teacher Resources and References* on page 45.
- Have the students observe different plants that are damaged by pests and then write a story about one of the plants from the perspective of the pest.
- Raise insects that are beneficial to your area. Examples include lacewings, ladybugs, and praying mantis. Refer to the *Teacher Resources and References* on pages 42-45.
- Read selected books aloud to the class. Discuss how the insect, animal, or plant is either beneficial or harmful. See *Related Literature* on pages 48-49.
- Have the students bring in samples of flour, cereal, rice, and other grains. Place the samples in labeled yogurt containers. Observe the grains over time. Watch for moths, grain weevils, molds, etc. Look at the pests and damage under a microscope. How is the damage detrimental to the farmer, consumer, grocer, nation's economy, and/or the environment? If pests are not observed, discuss processing and storage techniques that are used to control pests.
- Obtain a copy of *Red Imported Fire Ants: Facts About These Interesting Insects* and perform one or two activities from the booklet. Ordering information can be found on page 45.

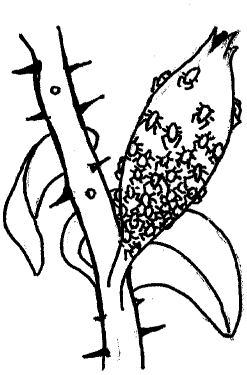
Aphids

Reading #1

Aphids are small, pear-shaped insects that suck the juices from plants. Aphids can be green, red or brown depending on their age, the aphid species, and the color of the plant juices they consume. Aphids can be wingless or have two pairs of wings.



Aphids have a mouthpiece called a proboscis that works like a straw. The aphids inject their proboscises into the plant phloem (a special channel that transports sugars and other nutrients throughout the plant) and suck the plant juices up into their mouths. The aphids take food that plants have made for themselves and use it as their own food.



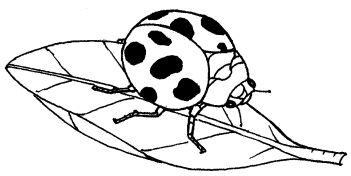
Aphids produce a sweet secretion called "honeydew" as they feed on plant sap. Ants like eating this honeydew. Ants will protect aphids as if they were tiny dairy cattle. They keep other insects from attacking the aphids. The ants "milk" the aphids by stroking them with their antennae. The sticky honeydew is annoying to people.

Even though aphids are very small (3-4 millimeters long) they cause lots of damage to many young crops and household gardens because they feed together in large groups. Aphids not only weaken young plants by removing their sap, but they sometimes carry and transmit viruses as they feed from plant to plant.

There are many ways to control aphids:

- A simple way to reduce the number of aphids is to spray the infected plants with soapy water. This solution makes some aphids slide off the plants while other aphids suffocate. This method of control does not always work well for all aphids and does not kill harmful viruses. The soap must be used frequently to keep the number of aphids to a minimum. Special insecticidal soaps, soaps containing aphid killing chemicals, are used to control aphids on strawberries and ornamental flowers.

- Another interesting way to control aphids is to release beneficial insects into aphid-infested gardens or fields. The larval and adult forms of ladybugs and green lacewings eat aphids. Ladybugs and lacewings are sometimes raised by people and sold to farmers and home gardeners.



- An unusual way of controlling aphids is by exposing them to a special tiny wasp. These speck-sized wasps inject their eggs into the bodies of aphids. When the wasp eggs hatch into larvae, the larvae eat the aphids from the inside. The larvae change into adults which emerge from the dead aphids and repeat the cycle. These wasps are parasites—which means they harm others while benefiting themselves. If you examine an aphid population in your garden, you may be able to see some brown aphid mummies.

- Some farmers use insecticides, special chemicals that kill insects, to get rid of aphids quickly. These chemicals may also kill other insects at the same time.

Generally, it is preferred to reduce an aphid population in a particular area rather than completely eliminate the aphids. Although aphids are considered a pest by many, it is important to remember that aphids are a food source for many insects and spiders. They are important in many ecosystems.

Farmers and home gardeners should consider all methods of aphid control and pick the methods which are best suited for their particular situations. People should consider the methods that will be most effective on pest control while minimizing the impact to the environment. This is called Integrated Pest Management or IPM.

Glassy-winged Sharpshooter

Reading #2

Perhaps you have heard about the glassy-winged sharpshooter on the television news or in the newspaper. This insect is being talked about by many because it has the potential of spreading diseases, including Pierce's disease, to more than one hundred kinds of plants. The biggest threat is to grapes in California, but other crops and our environment can be affected too.

The glassy-winged sharpshooter, almost ½ inch long, got its name because it has large transparent wings with reddish veins. This dark brown insect is easy to spot not only because of its size, but also because of the watery substance it excretes. The glassy-winged sharpshooter pushes its straw-like proboscis into a plant and sucks fluid from the plant and uses it for food. It has a voracious appetite and travels quickly from one plant to another. As it feeds, it excretes a large droplet of a watery substance every three seconds. This "leafhopper rain" turns to a white powdery substance when dry. The word "leafhopper" is given to insects, like the glassy-winged sharpshooter, that move quickly from one plant to another.

During feeding, the glassy-winged sharpshooter can spread harmful bacteria into the plant. One such bacterium is called *Xylella fastidiosa*. These bacteria attack the xylem of plants. The xylem is the tissue which transports water and nutrients. The bacteria continue to grow and eventually choke the plants' water and nutrient transport system and cause the plant to die. If infected by Pierce's disease, grapevines will die within three years. Currently, there is not a remedy for Pierce's disease. The only way to prevent plants from getting the disease it to prevent the plants from being exposed to it. That means, not allowing the glassy-winged sharpshooter to feed on plants.

Xylella fastidiosa can harm and eventually kill other plants too. There is a strain that affects almonds. The leaves of the almond tree get brown, and the almonds do not get large enough to harvest. Another strain of *Xylella fastidiosa* can make the leaves of citrus trees yellow. This is a problem because the plant cannot make enough food for itself and therefore the fruit is too small. The bacterium acts the same way with all of the plants it infests. It chokes the xylem which prevents water from flowing freely through the plant.

As you read this, researchers throughout the state are trying to find a way to control the glassy-winged sharpshooter and prevent Pierce's disease. They are working on finding ways to destroy these insects, which are not native to California. One such research project is proving useful. There is a tiny, stingless wasp that eats sharpshooter eggs. Facilities in Southern California are reproducing these beneficial insects and releasing them as fast as they can.

Glassy-winged Sharpshooter

(continued)

Reading #2

Another method of control that seems hopeful is the use of biotechnology—using biological methods to make the plants resistant to Pierce's disease. The California Department of Food and Agriculture has put quite a bit of money into the research of the glassy-winged sharpshooter and Pierce's disease. That money came from an emergency senate bill that passed on May 16, 2000. Research takes a while, but scientists are hopeful that a solution to this challenge will be found.

Do you have an idea on how this challenge can be overcome?

Red Imported Fire Ants

Reading #3

Ants can be found almost anywhere—sidewalks, gardens, fields, school playgrounds, and in the woods. Sometimes we find them where we would rather not see them, like in the kitchen!

Ants belong to a class of animals called insects. All insects have three parts—a head, a thorax, and an abdomen. They also have two eyes, two mouth parts called mandibles, two antennae, and six legs.

Red Imported Fire Ants are one of many kinds of ants. The ants got their name because they are: reddish brown (RED), they are not originally from the United States (IMPORTED), and they can give a burning sting from the stinger on their abdomen (FIRE). Scientists believe that Red Imported Fire Ants came to the United States on ships from South America in the early 1930s. Since that time, these ants have become common in the southeastern United States. Only recently have the ants appeared in California.

Red Imported Fire Ants are difficult to distinguish from other California ants. They are very small, ranging from 1/16-1/4 inch and are reddish brown. They are most often identified by the unusual mounds they form. These mounds do not really look like mounds at all. Rather, they look more like flat patches of soil. Red Imported Fire Ants build nests just about anywhere they can find moisture, such as lawns, gardens, woodpiles, fields, golf courses, and parks. They frequently infest electrical equipment, chew on wire insulation and can cause short circuits. This could be very bad if the equipment they infest are things such as traffic signal boxes, pool pumps, air conditioners, and heaters.

Red Imported Fire Ants are a threat to people including agricultural workers, compete with beneficial insects, and destroy crops such as citrus, strawberries, and corn. The ants also attack and kill wildlife such as quail, lizards, squirrels, and baby deer. When disturbed, the worker ants "boil out" of the mound and sting the animal that bothered them.

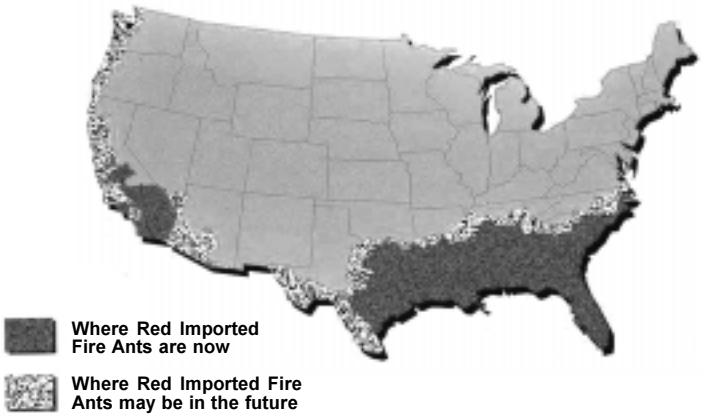
Right now, the ants have been spotted in Southern California. It is best to stay away from ant mounds and to show an adult if you see a lot of ant mounds or a large ant mound in a grassy area, like a park or school field.

Since Red Imported Fire Ants are not natural parts of California ecosystems, the current goal of the California Department of Food and Agriculture is to completely rid of all Red Imported Fire Ants from California. This is called eradication. The current process includes the use of two types of chemicals. One interrupts the growth of the insects and the other affects their metabolism—how they use the energy from their food. Both chemicals are

Red Imported Fire Ants *(continued)*

Reading #3

mixed with ground corncobs and soybean oil, a combination that is used to attract Red Imported Fire Ants. Working together, these chemicals may eradicate an entire colony in several weeks. The slow-acting characteristics of these chemicals are preferred because Red Imported Fire Ants are able to take the bait into the nest and distribute them to other workers and the queen before they die. If these methods work, California will not have the problems southern states have with the insect.



Rodents

Reading #4

Rodents are small mammals which have long chisel-shaped incisor teeth that are adapted for gnawing. In fact, rodents have incisors that continually grow; therefore, they must continually gnaw. If they don't, their teeth could get so long they could grow into another part of their own body! Some examples of rodents are rats, mice, beavers, squirrels, gophers, voles, and moles.

Rodents can be continuous pests because they are able to reproduce very quickly and have many young at one time. Also, rodents are very hearty animals. They can tolerate severe weather conditions and can survive on very little food, if necessary.

Rodents are common pests around homes. Mice often get into household foods intended for humans. Rodents are hazards to people because they have the potential of spreading dangerous diseases. They can carry fleas, which may carry a specific bacterium that causes high fever, rashes, and sometimes death.

Farmers do not like rodents in their fields. A group of ground squirrels can destroy nut, corn, rice, and other crops very quickly. If rodents, such as rats get into grain storage containers called silos, the food can no longer be used to feed people or to feed animals (such as cattle) that will be fed to people.

Rodents are controlled in various ways:

- In most cases, traps are set to kill the rodents that are bothering homeowners or farmers.

- Predators, such as owls and other raptors (birds of prey), can also control rodents. Farmers sometimes place owl boxes and raptor perches in their orchards to encourage more raptors that eat rodents.

- Rodenticides, chemicals that kill rodents (such as D-Con), are often placed in homes. People who use rodenticides must be careful not to place the poisons around children or pets that might accidentally eat or play with the poison. Another danger with rodenticides is that the chemicals may still be present in the rodent after it dies. When a cat, dog, turkey vulture, or other animal eats the dead rodent, it may be harmed by the chemicals inside the rodent's body.

Rodents *(continued)*

Reading #4

- Perhaps one of the most effective ways to control rodents is to eliminate their favorite habitats. Removal of brush, lumber, trash, and other potential nesting places often removes the presence of rodents.

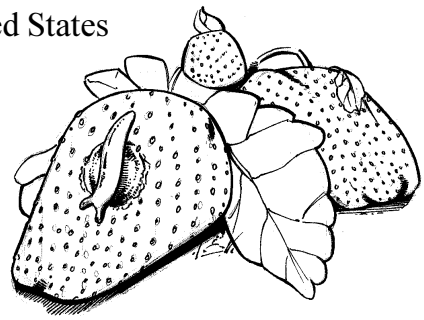
- California ground squirrels, pocket gophers, meadow mice, moles, and voles are some rodent pests responsible for damaging many California fields. In some areas, ground squirrels and voles can reduce alfalfa yields so drastically that farmers can lose millions of dollars each year. That means higher prices to the consumer—you! One control for ground squirrels and other rodents is to use bait traps. These bait traps capture and kill the rodents. Another way to eliminate small infestations of rodents is to fumigate rodent burrows before planting. This kills the existing rodents before crops are planted.

People should consider the most appropriate forms of rodent control for each particular situation. One or more methods may be used. Using a combination of pest management strategies that best controls the pest with minimal impact to the environment is call Integrated Pest Management or IPM. Researchers are constantly developing new ways of controlling rodents. Have you heard of other ways that people control rodents?

Snails, Slugs, and Other Mollusks

Reading #5

If you go out in your garden or yard at night with a flashlight, you may find snails or slugs feeding on the tender leaves of your plants. Snails and slugs are mollusks and are common to farms as well as home gardens. If not controlled, young seedlings can be consumed by these mollusks in one evening. Snails and slugs feed mostly at night and hide in moist dark places during the day.



One reason common garden snails are such pests in the United States is that they are not sufficiently controlled by natural enemies such as birds, beetles, snakes, and toads. The first garden snails were brought to the United States from France during the 1950s and were originally raised for "escargot," a dish considered a delicacy by many. The snails reproduced rapidly, traveled out of gardens in which they were raised, and are now a problem throughout the United States.

There are a variety of ways to control snail and slug populations. These include removing them by hand, clearing away ground cover in cool shady places, creating physical barriers, placing salt directly on the animals, and using slug and snail bait. It is important to consider the side effects of certain snail and slug control methods—Should bait be used in areas where children play or food is grown? Can the salt affect soil quality? It is best if all pest management strategies are considered before making a pest control plan which most likely includes several methods. This is called Integrated Pest Management or IPM.

Snails are a common pest to citrus trees such as lemon, orange, and grapefruit. Farmers put copper rings, ranging from 3" to 12" high, around the tree trunks. The snails will not cross this physical barrier because, if they do, they will receive an electrical shock when their slime reacts with the copper. Humans cannot detect this mild electric charge, but snails and slugs can. One species of snail, called a decollate snail, is a predator of the brown garden snail. These snails are specifically raised and released in snail-infested orchards and row crops. Scientists got this idea by observing how snails were kept under natural control in European countries. The release of decollate snails is carefully regulated because they eat many types of young mollusks, including some that are endangered.

Another interesting mollusk has found its way into California. The Chinese mitten crab, native to the estuaries of Korea and China, has become established in the San Francisco

Snails, Slugs, and Other Mollusks *(continued)*

Reading #5

Estuary. An estuary is the mouth of a river or stream that has contact with seawater. In the Sacramento-San Joaquin Delta, the crab's burrowing activity weakens levees, which can cause flooding, and competes with another scavenger, the crayfish, which supports the local fisheries. Mitten crabs spawn (lay eggs) in saltwater and spend their juvenile life in fresh water. Mitten crabs have been found many miles north of Sacramento.

The next time you see a mollusk in your garden, think about how it impacts your garden. It is food for birds, yet eats your plants. Snails and slugs decompose plant material so nutrients can be returned to the soil. As you can see, the interactions between living things are complex. It is no wonder the area of pest management is unique, challenging, and often times confusing.

Weeds

Reading #6

Weeds! They spring up almost everywhere—crowding, strangling, shading, and competing for nutrients and water. Weeds are plants that are a nuisance in gardens, agricultural fields, rangelands, recreational areas, and even waterways.

A weed is "a plant growing in a place where it is not wanted." Plants can be weeds at certain times and in certain places, but can be beneficial at other times and places. For example, the milkweed plant is the essential food for monarch butterfly caterpillars; without it, the monarch cannot survive. Milkweed plants contain digitoxin. Digitoxin is used to produce a human heart medicine called "digitalis." Milkweed, however, can also be a pest in home gardens, in fields, and in orchards. It makes the areas look unattractive as well as takes nutrients that the desired plants need. Sheep ranchers walk their rangelands and remove milkweed by hand because lambs will get sick and may even die if they eat it. The digitoxin inside the plant is harmful to livestock.

If you like hiking, biking, or horse riding, chances are you are very familiar with yellow starthistle. This spiny, yellow flowered thistle is a member of the sunflower family and was accidentally imported as a contaminant in alfalfa seed. It quickly takes over areas of rangeland because it does not have natural enemies in California. It is poisonous to horses causing an illness called "chewing disease."

California agriculture currently depends on the movement of water from one place to another through rivers, irrigation canals, and aqueducts. These waterways can become clogged by particular waterweeds. One such waterweed is called hydrilla. This weed looks similar to the elodea people use in home aquariums. But instead of smooth leaves, hydrilla has rough leaves with sawtooth edges and small potato-like, peanut-sized tubers on the roots.

Weeds are controlled in many ways:

- The most common weed control techniques are cultivation with tractors, hoeing, mowing, and physically pulling weeds out by hand.
- Some farmers and home gardeners cover soil with dark plastic to prevent weeds from sprouting.
- Herbicides (chemicals that kill weeds) are sometimes used to

kill weeds. There are different kinds of herbicides for different kinds of weeds.

- Another form of weed control is called crop rotation. An example of this is when densely growing crops, such as wheat or rye grasses, are planted in the soil where row crops, like tomatoes or pumpkins, once grew. The wheat or rye crowds out the weeds by taking the nutrients and water that the weeds once had. They also shade the area, preventing the weeds from getting the sunlight they need to grow.

- Sometimes a fire is purposely set in rangeland full of starthistle. These prescribed fires (or burns) kill the starthistle and allow the native plants to begin growing again. One year after burning, poppies, lupines and other native plants can be seen in the area. After burning areas three years in a row, scientists have found that most of the starthistle seeds are destroyed and an area is restored. You can imagine though, how carefully monitored these burns must be.

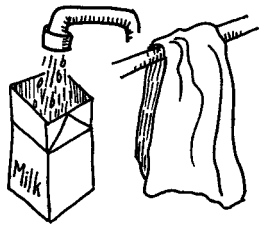
- A method of control called biological control is also used to kill starthistle. Since the 1980s two type of flies and two types of weevils (beetles with long snouts), have been introduced into starthistle infested areas. Some of these insects eat starthistle only. Others feed on the flower of the plants, reducing the number of seeds produced each year.

- In some residential areas, goats are used to eat weeds. This practice is becoming popular in residential areas that have large open grasslands nearby. The goats are raised for their hair and consume any vegetation they are around. Oakland, Sacramento, and Los Angeles are three large cities using goats now.

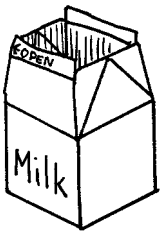
Successful home gardeners and farmers look at each weed situation individually and use a combination of pest management techniques to control the weeds. Farmers depend on specialists called Pest Control Advisors to help them make important decisions that will keep the crops growing while not harming the environment. This pest management approach is called Integrated Pest Management or IPM.

Making an Insect Observation Chamber

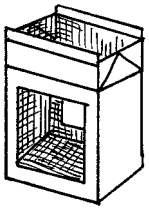
1. Rinse out and dry a school milk carton.



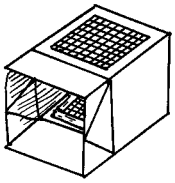
2. Completely open the top of the carton.



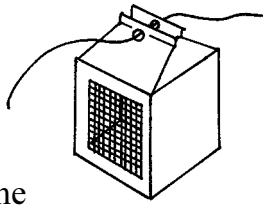
3. Cut two squares about 2" x 2" on two opposite sides of the milk carton. *Make sure there is at least 1/4 inch remaining on all sides of each square.*



4. Cut two pieces of screen that are slightly larger than the holes you cut. Place the screen inside the carton and tape it securely into place with masking tape.

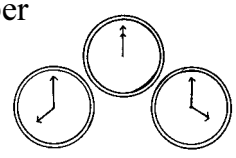


5. Punch two holes, on opposite sides, at the top of the milk carton. Thread a 20" piece of string through the holes and tie it together, loosely.

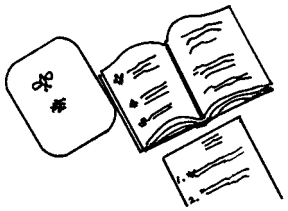


6. Decide on what insect attractants to use. Place them in the observation chamber and hang in a tree or bush.

7. Observe the chamber every day for about a week. Make sure that you observe the chamber during the early morning and evening hours as well as during mid-day.



8. Identify the insects that you trap by using an insect guide.



California Foundation For Agriculture In The Classroom

Pest Poetry

Purpose

The purpose of this activity is to familiarize students with insect characteristics and pest terminology, while practicing oral and written poetry skills.

Time

Teacher Preparation
15 minutes

Student Activity
One or two 50-minute sessions

Materials

For the teacher:

- Overhead projector
- Overhead transparency of the poem *Spider Mites* (page 30)
- Overhead transparency of the *Poem for Two Voices* student activity sheet (page 31)
- *Joyful Noise* book by Paul Fleischman *(optional)*
- Thesaurus *(optional)*

For each partnership:

- *Poem for Two Voices* student activity sheet *(2 copies)*

Background Information

The students will create a unique poem about a particular pest. The idea is to combine the knowledge students gain about a particular pest with poetry skills to create a poem that is read orally by two groups or individuals. You may find it useful to refer to the book *Joyful Noise* by Paul Fleischman before beginning this activity.

Procedure

1. Make an overhead transparency of the poem *Spider Mites* and another of the *Poem for Two Voices* activity sheet. Distribute copies of the poem to each student.

2. Divide the students into two groups. Group A will read column A of the *Spider Mites* poem and Group B will read column B of the poem. Discuss how the poems are written and read. Read *Spider Mites* as a class. **Note**: *Line 1 should be read, then line 2, and so on. If words appear in both columns of the same line, they should be read simultaneously.*

3. On the overhead projector, create a collaborative poem for two voices that is about a pest. It is important to elicit characteristics of the organism, such as colors, sounds, and actions. Divide the class into groups and read the poem together. **Note**: *Repetition of a phrase makes the poem sound more exciting.*

4. Pair the students and have them write their own pest poem for two voices. A possible procedure is described below:

    - Decide on the pest about which the poem will be written.
    - Brainstorm a list of characteristics about the pest—special colors, sounds, habitats, movements, etc.
    - Determine one or two words or phrases that will be repeated in the poem.

    - Write the poem on the *Poem for Two Voices* student activity sheet, keeping in mind that words written on the same line should be identical words, which will be read at the same time.

California Foundation For Agriculture In The Classroom

Pest Poetry

Materials *(continued)*

***For each student**:*

- Copy of *Spider Mites* poem (page 30)

Content Standards

Grade 4

Reading/Language Arts
Reading • 1.1
Writing • 1.1, 1.6, 1.7, 1.10
Written and Oral Language Conventions • 1.0
Listening and Speaking 2.4

Grade 5

Reading/Language Arts
Reading • 1.1, 1.5, 3.1, 3.5
Writing • 1.3, 1.4, 1.6
Written and Oral Language Conventions • 1.0
Listening and Speaking 1.0, 1.4, 1.5, 1.6

Grade 6

Reading/Language Arts
Reading • 1.1
Writing • 1.1, 1.4
Written and Oral Language Conventions • 1.0
Listening and Speaking 1.0, 1.1, 1.2, 1.8

- Read the poem as a team.
- Make necessary changes.
- Rewrite the revised poem neatly on a clean activity sheet.

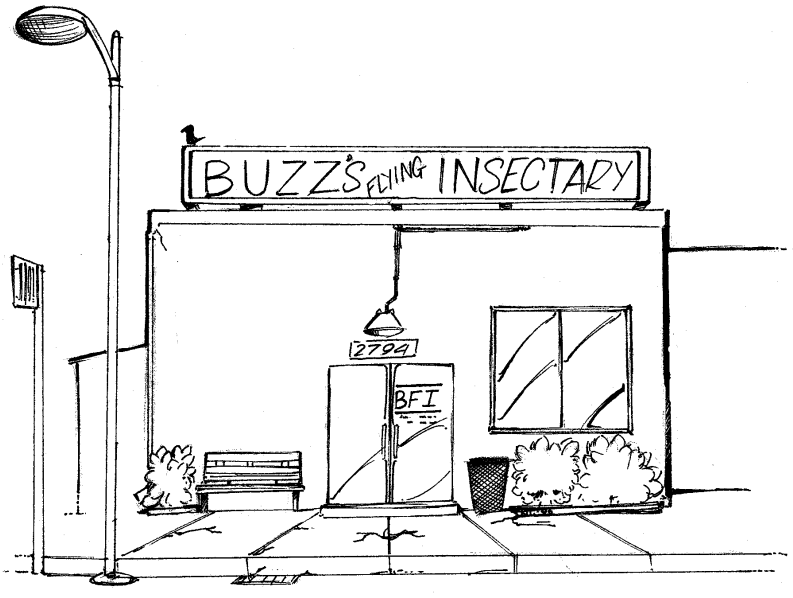
5. Have the students rehearse and perform their poems for classmates or duplicate the poems and have the entire class read each poem.

Variations

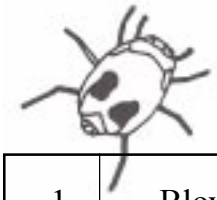
- Have the students create a standard poem or short story about a pest.
- Have the students create an illustrated children's book about a particular plant or animal and discuss what pests must be managed.

Extensions

- Invite a farmer or rancher to class to discuss pests and pest management strategies they encounter.
- Have the students gather and discuss current news articles about pests from newspapers and magazines.
- Have the students create a poem about an imaginary pest.



Spider Mites



	Column A	Column B
1	Blowing in the wind	Blowing in the wind
2		Drifting from field to field
3	Invaders	Invaders
4	Clinging, sucking, crawling	Clinging, sucking, crawling
5		Living off the leaves
6		Of strawberry plants
7	Large juicy berries	
8	No more	
9	Invaders	Invaders
10		Laying Eggs
11	Hatching	
12		Tiny in size
13	But growing quickly	
14	Blowing in the wind	Blowing in the wind
15	Spider mites	Spider mites

Written by: Ethan Heifetz, Arcata, California

Poem for Two Voices

Name _____

Student Activity Sheet

	Column A	Column B
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Author(s) _____

_____

California Foundation For Agriculture In The Classroom

A New Pest is Discovered!

Purpose

The purpose of this activity is to understand that all living organisms, including pests, require air, food, water, and shelter for survival.

Time

Teacher Preparation
20 minutes to gather supplies

Student Activity
One or two 45-minute sessions

Materials

For each team:

- Materials to make pests – pipe cleaners, felt, beads, toilet paper rolls, glue, markers, toothpicks, yarn, aluminum foil, construction paper, etc.
- Index cards
- Shoe boxes *(optional)*

For each student:

- *What I Learned About Pests and Pest Management* (page 35)

Background Information

With few exceptions, living organisms require air, food, water, and shelter for survival. In this activity, the students will be asked to create a pest and a habitat for their pest. Prior to creative group work, you may choose to discuss the habitats of several agricultural pests listed in the background information and student readings.

Remind the students of Integrated Pest Management (IPM). This strategy encourages the farmer to look at each situation individually and to use what is best environmentally and economically. Encourage your students to create several ways to control their pests.

Discuss that all living organisms have a role in the environment. Discuss what effect population reduction or extinction may have on the environment and other ecosystems. The complexity of living and non-living interactions should be examined.

Procedure

1. Place students into groups of two, three, or four.
2. Discuss with the students that all living things require air, food, water, and shelter to survival. Explain to the students that they are going to invent, design, and build a pest.
3. Show the students the supplies that are available.
4. Have the students do the following:
   - Decide what the pest will do.
   - Build an imaginary pest out of the supplies that are available, keeping in mind that the pest requires air, water, food, and shelter.
   - Name the pest.
   - Determine the quantities of the pest needed to cause significant damage.

California Foundation For Agriculture In The Classroom

A New Pest is Discovered!

Content Standards

Grade 4

Science
Life Sciences • 2b, 3a, 3b

Reading/Language Arts
Writing • 1.0, 1.2, 1.4
Written and Oral Language Conventions • 1.0, 1.1
Listening and Speaking 1.0, 1.5, 1.6, 1.7, 2.0, 2.1

Grade 5

Reading/Language Arts
Writing • 1.0, 1.2, 1.6
Written and Oral Language Conventions • 1.0
Listening and Speaking 1.0, 1.4, 1.5, 2.2

Grade 6

Science
Ecology • 5c, 5d, 5e

Reading/Language Arts
Writing • 1.0, 1.2, 1.6
Written and Oral Language Conventions • 1.0, 1.1, 1.4
Listening and Speaking 1.0, 1.4, 1.5, 1.6, 2.2

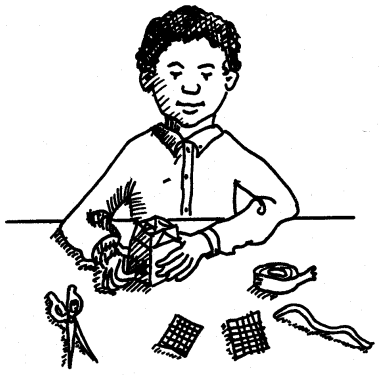
- Decide how the pest is controlled.

5. Have the students prepare cue cards for an oral presentation.

6. Have the students present their pests to the class for discussion.

7. As a culminating activity, have the students write about what they have learned about pest management. A writing sample activity is included on page 35.

Variations



- Have the students bring in pest-building supplies from home.
- Have the students create a shoe box habitat for their pest.
- Create *A Book of New Pests*, which includes illustrations and descriptions of student-designed pests.

Extensions

- Do the *Project WILD* "Habitat Lap Sit" and discuss the interdependence of organisms in an ecosystem and their requirements for food, shelter, water, and air. See page 45.
- Do the "Habitat Rummy" activity from *Project WILD* to describe the components of wildlife habitat. See page 45.
- Have the students research an actual agricultural pest and prepare a creative display or presentation. Some possible pests may include:

a) spider mites, which reduce the size of strawberries
b) bacteria, which cause hoof rot in cattle and sheep
c) milkweed, which is deadly to lambs
d) the tomato horn worm, which destroys tomato plants
e) salmonella bacteria, which causes food poisoning
f) poison oak or poison ivy, which cause rashes on humans
g) the Africanized honeybee, which has migrated to California
h) the Mediterranean fruit fly, which threatens California's fruit

A New Pest is Discovered!

- Have the students research a beneficial pest management organism or method. Call them "Pest Busters." Examples include:

  a) bacillus thuringiensis
  b) raptors
  c) no-till cultivation
  d) parasitic wasps or snails
  e) native plant species borders
  f) crop rotation

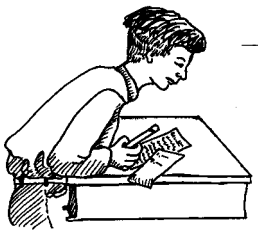
- Have the students learn about anaerobic bacteria, which do not require oxygen for reproduction.

- Have the students create an "America's Most Wanted Pest" poster for a real or imaginary pest.

What I Learned About Pests and Pest Management

Name _____

Directions: Over the past few weeks, you have learned about various pests and how they are managed. Think about what you have learned and write about it in the space below. Include these key words in your writing: agriculture, beneficial, careful, chemical, control, crop, environment, harmful, insect, manage, mold, monitor, pest, pest management, reduce, rodent, and weed.



California Foundation For Agriculture In The Classroom

Answers to Commonly Asked Questions

Pest and Pest Management Background Information

What is a pest?

Generally speaking, a pest is an organism that is troublesome or annoying to another organism. Any animal, plant or microorganism that is in an unwanted place at a particular time or location can be a pest. Common pests include insects that eat our plants or bother or harm animals or humans; weeds in our gardens and farms; rodents in our homes; and mold on our fruit.

The United States Environmental Protection Agency (EPA) defines an agricultural pest as "an unwanted organism; a living thing that competes with people for food and fiber, attacks people or livestock directly, or annoys or otherwise affects aesthetic human values."

What is entomology?

Entomology is the scientific study of insects. Insects are just one of many types of organisms that can be considered pests. It is important to realize and emphasize to students that insects are an integral part of most ecosystems. They are often at the bottom of food chains and are a major food source for many living organisms. The interactions between living things are extremely complex. These interactions must be considered when looking at pest management strategies.

What is pest management?

Pest management is a general approach to pest control which emphasizes keeping pests at a manageable level rather than seeking to eliminate them entirely. What is considered a manageable level may vary from one person to another or from one crop to another. It may also have to do with timing. Aphids may be a serious problem to a plant while it is young but not life threatening to a plant after it matures. Pests may be controlled by biological, chemical and cultural means. As the world human population continues to increase, the demand for food also continues to increase. Reducing food loss to pests is one way of providing more food for humans.

What is a pesticide?

A pesticide is a chemical, manufactured or natural, used to control pests. There are a variety of pesticides including insecticides, which control insects; herbicides which control plants; fungicides which control molds and other fungi; nematocides which control nematodes (microscopic roundworms); rodenticides which control rodents, such as rats and mice; and antibiotics which control bacteria.

California Foundation For Agriculture In The Classroom

Answers to Commonly Asked Questions

Pest and Pest Management Background Information

Early success with chemical pesticides led to a decreased reliance on other forms of pest control, such as crop rotation. In addition, the total ecological effects of such chemicals were often not understood. A few pesticides, such as DDT, were later found to persist in the animal and human food chain or to destroy natural predators, such as birds, long after application. Today, government laws and regulations require a thorough understanding and documentation of a pesticide's potential impact on humans and the environment before the pesticide can be used.

How are pesticides regulated?

Before a pesticide can be registered for use, the manufacturer must thoroughly test it for toxicity. Both acute and long-term exposure studies are required. According to testing procedures specified by the U.S. Environmental Protections Agency (EPA), this testing requires many years to complete and all results must be reported to the EPA. If the test results on safety standards are acceptable, the EPA registers the product for use. The EPA puts certain conditions on the use, such as requiring protective gear or not entering a field or harvesting a crop for a certain period of time after application. Some states, particularly California, have additional laws requiring further tests on safety and effectiveness before a pesticide can be used in the state.

There are many laws and regulations that specify how pesticides must be used. These laws apply to household use as well as on-farm use. For example, the chlorine used in swimming pools and the insect repellent used to keep mosquitoes away from people, go through the same EPA registration process.

What is Integrated Pest Management?

The term Integrated Pest Management (IPM) has many definitions. In all cases, however, it is one component in an overall crop or animal production system. IPM is based on the principle of providing growers with the widest array of options to control pests including cultural, biological, chemical, and genetic techniques. The ultimate goal of IPM is to ensure production of abundant high-quality food and fiber in an environmentally and economically sound manner.

The important components of IPM are:

1. *Accurate identification of pests.* This includes accurate pest counts; a thorough understanding of the pest's life cycle; and an understanding of how the pest is impacted by factors in the field,

Pest and Pest Management Background Information

such as the presence of beneficial organisms, crop vigor, and weather.

2. *An understanding of pest tolerance threshold—both ecologically and economically.* Questions to consider include: Is a method of pest control truly needed? Is the pest count high enough to cause significant damage? Will the cost of controlling the pest be greater than the profit to the farmer or raise the cost to the consumer to an unreasonable level? What will happen to the ecosystem when the quantity of the particular pest is reduced?

3. *Determining a method of control.* Once the pest is identified, and its threshold is exceeded, then the various methods of control must be examined and the best plan for action implemented.

The concept of IPM has roots back to the beginning of the century when farmers, agricultural researchers, and farm suppliers began working together to control pests. Formal IPM practices were established in the early 1960s.

What are some pest management techniques?

Biological Control

Biological control is when a living organism is used to reduce the quantity of a pest. The most common examples of biological pest management involve the use of beneficial insects to prey on insect pests. These beneficial insects usually exist naturally often in numbers too small to provide dependable control. Farmers can promote the increase of beneficial insect populations by providing an environment that encourages their propagation. Farmers may also introduce additional beneficial insects which they have purchased from a commercial insectary. Beneficial insects can often reduce the number of insect pests to a tolerable level. Ladybugs and lacewings are examples of beneficial insects.

Mosquito fish (gambusia), dragonflies, predacious diving beetles, and backswimmers are natural predators of mosquitoes or mosquito larvae. When purposely placed in areas of potential mosquito infestation, these predators alone can sometimes keep the mosquitoes in check. This is especially important where mosquitoes can spread diseases such as encephalitis and malaria.

Rodents are often pests to farmers, gardeners, and homeowners. The placement of owl boxes and raptor perches in fields and orchards can

Pest and Pest Management Background Information

increase the number of these predators, which in turn control the rodent population.

Biological control can also include selecting strains of plants or animals that resist certain pests. It can also include altering the genetic make-up of a plant or animal so it can resist a pest to which it is vulnerable. This form of control fits into the categories of biotechnology and genetic engineering.

Cultural Control

Crop rotation is an important cultural method of controlling pests. For example, a certain type of nematode (a microscopic roundworm that lives in the soil) parasitizes the roots of cotton plants causing severe loss of yield. These nematodes can be controlled if cotton crops are alternated with other crops, such as small grains or alfalfa. These alternate crops are not suitable hosts for the nematodes, and therefore, the nematode population decreases in years when these crops are grown.

Planting mixed stands of trees or crops instead of planting large areas with just one type of plant is used in some areas as a pest management technique. Research is still continuing in this area.

Placing mulches and cover crops on top of the soil is used to control weeds. This prevents the seeds beneath the soil surface from growing because they are not exposed to light. The physical removal of weeds by tractor, by hand, and by hoeing, are still common ways of removing weeds in fields and orchards. There are a variety of other ways to control weeds mechanically.

Chemical Control

As previously discussed, chemicals known as pesticides are used in conjunction with other practices to control pests. There are a variety of pesticides, some natural and others synthetic. Insecticides control insects, fungicides control fungi, herbicides control weeds and rodenticides control rodents. For further information, refer to the questions “What is a pesticide?” and “How are pesticides regulated?” on pages 37 and 38.

What’s new in pest management?

Phermones are chemicals naturally released by animals to communicate with other members of their species. Phermones that act

Answers to Commonly Asked Questions

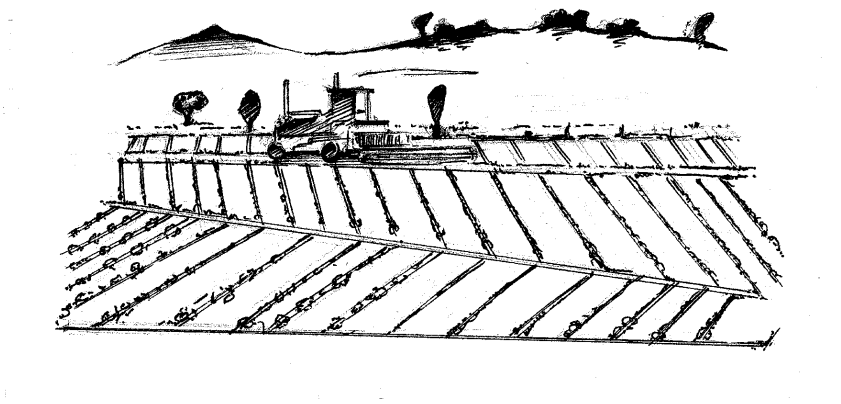
Pest and Pest Management Background Information

as sex attractants for insect mating are used in commercial agriculture. These synthetically produced phermones are placed in traps to attract insects. Most of these traps have sticky substances or special openings that prevent the insect form leaving the trap. For some insects, simply releasing a high level of phermone over a long period of time confuses the adult insects so that they cannot find a partner to mate with. This is called "phermone confusion."

Genetic engineering, where genetic material from one organism is inserted into another, can produce crops that are resistant to pests or crops that produce their own toxins which are harmful to specific pests. Also, genetic engineering is used to produce crops that are resistant to a particular herbicide—the entire field can be sprayed with this herbicide, leaving the crop unharmed while removing all other weedy pests. Examples of plants bioengineered for pest resistance include some varieties of tomatoes, cotton, papayas, corn, soybeans, and canola.

New pest management strategies are continually being developed. Currently, concerted effort is being made to control Pierce's disease, which is easily spread by the Glassy-winged sharpshooter. Red Imported Fire Ants are now a potential threat to California agriculture. Your students can learn about these pests in the student lesson *Quit Pestering Us*! on pages 11-27 of this unit.

The major component of ecological sustainability is continuous working partnerships between farmers, researchers, industry, and the public. Together these groups can provide a wide variety of pest management strategies that will benefit consumers and the environment. You and your students are an important part of this process.



California Foundation For Agriculture In The Classroom

Teacher Resources and References

Agricultural Research Service Magazine
Published monthly by the Agricultural Research Service, United States Department of Agriculture, this magazine reports on current research in the agricultural industry. Free one-year subscription to schools and libraries.

Agricultural Research Service
Attn: JoAnn Frazier, Information Staff
5601 Sunnyside Avenue, 1-2232
Beltsville, MD 20705-5130
(301) 504-1660
Fax: (301) 504-1641
Web Site: www.ars.usda.gov/is

ANR Communication Services, Catalog Publications
Pamphlets, books, slide sets, and videos on agriculture, crops, livestock, soil, water, and more. Free catalog.

University of California
ANR Communcation Services
6701 San Pablo Avenue
Oakland, CA 94608-8849
(800) 994-8849
Fax: (510) 643-5470
Web Site: anrcatalog.ucdavis.edu

BAC Attack
A video and series of over ten activities that teaches students about food safety. Catchy titles include *Soapy Solutions* and *Proper Patties*. . One free copy per school when requested online or by fax on school letterhead.

BAC Attack
c/o Video Placement Worldwide
Post Office Box 58142
Saint Petersburg, FL 33715-9976
(312) 782-8424
Fax: (800) 358-5218
Web Site: www.vpw.com

California Department of Pesticide Regulation
This organization regulates the use of pesticides to protect human health and the environment. It has on-line fact sheets available as well as a *Good Bug Book* that can be downloaded from its Web site.

Department of Pesticide Regulation
1001 I Street
Sacramento, CA 95814
(916) 324-4100
Fax: (916) 324-4088
Web Site: www.cdpr.ca.gov

California Foundation for Agriculture in the Classroom
Provides a variety of programs and resources, which can increase the understanding of agriculture and its impact in today's world. Commodity and natural resource fact and activity sheets, lesson plans and teacher and student programs are available. Request a free teacher packet.

California Foundation for Agriculture in the Classroom
2300 River Plaza Drive
Sacramento, CA 95833
(800) 700-2482
Fax: (916) 561-5697
Web Site: www.cfaitc.org

California Native Plant Society
A variety of brochures and information pieces are available.

California Native Plant Society
1722 J Street, Suite 17
Sacramento, CA 95814
(916) 447-2677
E-Mail: cnps@cnps.org
Web Site: www.cnps.org

California Foundation For Agriculture In The Classroom

Teacher Resources and References

California Science Teachers Association
This association provides newsletters, journals, and conferences for California science educators about ideas, issues and trends in science education. Annual membership fee.

CSTA
3550 Watt Avenue, #120
Sacramento, CA 95821-2666
(916) 979-7004
Fax: (916) 979-7023
Web Site: www.cascience.org

CDE Press
The Content Standards for California Public Schools and subject matter frameworks are available through this company. They are also available on the California Department of Education Web site listed.

CDE Press, Sales Office
California Department of Education
Post Office Box 271
Sacramento, CA 95812-0271
(916) 445-1260
Fax: (916) 323-0823
Web Site: www.cde.ca.gov

Center for Engineering Plants for Resistance Against Pathogens
This organization has a variety of free resources and programs for educators, including the one described below.

Germ War is a sixth through ninth grade interactive computer program that describes how people and plants defend themselves against microbes and how biotechnology can help prevent and treat disease.

Center for Engineering Plants for Resistance Against Pathogens
University of California, Davis
One Shields Avenue
Davis, CA 95616
(530) 752-6552
Fax: (530) 752-6523
Web Site: ceprap.ucdavis.edu

The Changing Forest: Forest Ecology
This secondary educational unit explains how species introduced to nonnative environments can be beneficial or detrimental to the ecosystem. Good background information for elementary teachers. Inservice required to obtain materials.

Project Learning Tree
California Deparment of Forestry and Fire Protection
Post Office Box 944246
Sacramento, CA 94244-2460
(916) 653-7958
Fax: (916) 653-6378
Web Site: www.plt.org

Council for Biotechnology Information
This organization's purpose is to share information about biotechnology, relying on scientific research, expert opinion and published reports. Free information is available including a brochure, *Biotechnology: Good Ideas Are Growing*.

Council for Biotechnology Information
Post Office Box 34380
Washington, DC 20043-0380
(202) 467-6565
Fax: (202) 467-5777
Web Site: www.whybiotech.com

County Agricultural Commissioner's Office
Refer to your local telephone book under the county government sections for address and phone number. Pest traps and brochures are available.

Entomological Society of America
Request the Bug Briefs lesson plans for teachers. The Bees Wax newsletter and The Insect Workbook are available for young people. Students can request applications for Entomological Society of America's Youth Membership.

Entomological Society of America
9301 Annapolis Road
Lanham, Maryland 20706
(301) 731-4535
Fax: (301) 731-4538
Web Site: www.entsoc.org

California Foundation For Agriculture In The Classroom

Teacher Resources and References

Environmental Education Resources Pamphlet
This pamphlet lists contact information which can be used by educators to receive information, posters, etc., on specific topics. Organizations listed are members of the California Environmental Education Interagency Network (CEEIN).

California Department of Education
Environmental Education Office
Post Office Box 944272
Sacramento, CA 94244-2720
(916) 322-9503
Fax: (916) 322-9360
Web Site: www.cde.ca.gov/cilbranch/oee

Fertile Ground Books
Access Web site for listings of agricultural books on crops, water, livestock, horticulture, business, pest management, and land use.

Fertile Ground Books
3912 Vale Avenue
Oakland, CA 94619
(530) 298-2060
(530) 298-2060
E-Mail: books@agribooks.com
Web Site: www.agribooks.com

Glassy-Winged Sharpshooter Brochure
This tri-fold brochure developed by ANR Communication Services for the University of California Pierce's Disease Research and Emergency Response Task Force, describes the identification, detection, and lifecycle of the Glassy-Winged Sharpshooter. Free.

California Department of Food and Agriculture
Pierce's Disease Control Program
2014 Capital Avenue, Suite 109
Sacramento, CA 95814
(916) 322-2804
Fax: (916) 322-3924
Web Site: www.plant.cdfa.ca.gov/gwss

The Great Food Fight
This 13-minute video with accompanying teaching materials presents food safety information including content on foodborne illnesses, microorganisms and proper food handling. One free copy per school when requested online or by fax on school letterhead.

The Great Food Fight
c/o Video Placement Worldwide
Post Office Box 58142
Saint Petersburg, FL 33715-9976
(312) 782-8424
Fax: (800) 358-5218
Web Site: www.vpw.com

Insect Lore
Specializes in living science kits including butterflies, silkworm eggs, ladybugs, ants, praying mantises, and earthworms. Videos, puppets, plant growing kits, games, science projects, puzzles, and music are also available. Free catalog.

Insect Lore
Post Office Box 1535
Shafter, CA 93263
(800) LIVE BUG
Fax: (661) 746-0334
Web Site: www.insectlore.com

Junior Master Gardener$_{SM}$ Program
A youth gardening project of the Texas Agricultural Extension, modeled after the Master Gardener program for adults. JMG teaches horticultural and environmental science concepts and leadership development through fun garden-related activities. It is suitable for many different groups including schools, after-school programs, and youth clubs.

Junior Master Gardener Program
California State Coordinator
669 County Square Drive, Suite 100
Ventura, CA 93003
(805) 662-6943
(805) 645-1474
Web Site: jmgkids.com

Teacher Resources and References

Plant Doctor®
The Plant Doctor® Program teaches children about safe and abundant agricultural food, fiber, and ornamental production. Includes lesson plans and experimental procedures on weed, pest, and disease control, as well as fertilization. The program can include a visit (based on availability) by a Plant Doctor®—a licensed pest control advisor. This information is available on-line.

The Stanley W. Strew Education Fund, Inc.
1143 North Market Boulevard
Sacramento, CA 95834
(916) 928-1625
Fax: (916) 928-0705
Web Site: www.plantdoctor.org

Project WILD
This program is a supplementary K-12 environmental education program. Includes numerous lessons which can be integrated into the curriculum. Workshop required to obtain materials.

California Department of Fish and Game
Project WILD
1416 9th Street, Room 1326-2
Sacramento, CA 95814
(888) 945-3334
Fax: (916) 653-3772
Web Site: www.dfg.ca.gov

Red Imported Fire Ants: Facts About These Interesting Insects
This booklet is designed to provide teachers with facts and activities to teach children about Red Imported Fire Ants, a potentially dangerous and destructive insect to the people, animals, and plants of California. Downloadable free from the Web site listed below.

California Department of Food and Agriculture
1220 N Street
Sacramento, CA 95814
(916) 654-0462
Fax: (916) 657-4240
Web Site: www.fireant.ca.gov

Rincon-Vitova Insectaries, Inc.
Has beneficial insects available for purchase. Catalog available for beneficial insects and supplies for low risk pest control.

Rincon-Vitova Insectaries, Inc.
P.O. Box 1555
Ventura, CA 93002
(805) 643-5407
Fax: (805) 643- 6267

California Foundation For Agriculture In The Classroom

Pest Management and Related Web Sites

This list is offered as an informational resource only. It contains Web sites established by various entities and, at the time of printing, included information on pest management or a subject matter related to the instructional materials unit *What's Bugging You?* The list is not considered to be all-inclusive. The entities or contents of the sites on this list are not necessarily endorsed by the California Foundation for Agriculture or by the authors of *What's Bugging You?*

Agricultural Research Magazine
www.ars.usda.gov/is/AR

American Farm Bureau Foundation for Agriculture
www.ageducate.org

California Association of Nurserymen
www.can-online.org

California Department of Food and Agriculture, Glassy-winged Sharpshooter
www.plant.cdfa.ca.gov/gwss

California Department of Food and Agriculture, Red Imported Fire Ants
www.fireant.ca.gov

California Department of Food and Agriculture, Weed Management Area
www.cdfa.ca.gov/wma

California Department of Pesticide Regulation
www.cdpr.ca.gov

California Farm Bureau Federation
www.cfbf.com

California Fertilizer Foundation
www.calfertilizer.org

California Foundation for Agriculture in the Classroom
www.cfaitc.org

California Native Plant Society
www.cnps.org

California Plant Health Association
www.cpha.net

California Table Grape Association
www.tablegrape.com

Center for Engineering Plants for Resistance Against Pathogens
ceprap.ucdavis.edu

Council for Biotechnology Information

Pest Management and Related Web Sites

www.whybiotech.com

Entomological Society of America
www.entsoc.org

Insect Lore
www.insectlore.com

National Gardening Association
www.garden.org

***Noxious Times* Newsletter**
www.cdfa.ca.gov/noxioustimes

Plant Doctor
www.plantdoctor.org

Return to the Natives: Restoration Education Project
www.monterey.edu/students/dh/detkajon/world/ron

United States Department of Interior's Bureau of Land Management, Weeds
www.blm.gov/weeds

United States Environmental Protection Agency
www.epa.gov

University of California Integrated Pest Management Project
www.ipm.ucdavis.edu

University of California Sustainable Agriculture Research and Education Program
www.sarep.ucdavis.edu

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Related Literature

Aliki. ***A Weed is a Flower: The Life of George Washington Carver***. Simon & Schuster, Inc., 1988. Describes the many interesting discoveries this man made including his thoughts on certain aspects of pest control.

Brenzel, Kathleen N. ***Western Garden Book***. Sunset Editions, 1997. This thematically organized guide provides information on a variety of plants and how to care for them around your home.

Carle, Eric. ***The Very Hungry Caterpillar***. Philomel Books, 1987. Enjoy an edible journey as a caterpillar eats an unusual diet and turns into a beautiful butterfly.

Cole, Henry. ***Jack's Garden***. William Morrow & Company, 1995. Shows what happens in Jack's garden after he plants seeds.

Cranshaw, Whitney. ***Pests of the West***. Fulcrum Publishing, 1998. This guide helps gardeners in the identification of insects and takes a sensible approach in controlling unwanted "bugs."

Dorros, Arthur. ***Ant Cities***. Harper Collins Children's Books, 1988. This simple text with detailed illustrations inform the reader about ants, their behavior, and habitats.

Fleischman, Paul. ***Joyful Noise: Poems for Two Voices***. Trumpet Club, 1988. Enjoy the rhythm of these melodic poems intended to be read aloud by two people or two groups of people.

Fleischman, Paul. ***Seedfolks***. HarperCollins, 1997. One by one, a number of people of varying ages and backgrounds transform a trash-filled inner-city lot into a productive and beautiful garden. In doing so, the gardeners themselves are transformed.

Glaser, Linda. ***Wonderful Worms***. Millbrook Press, 1996. Describes the physical characteristics, behavior, and life cycle of the common earthworm.

Godkin, Celia. ***What About Ladybugs?*** Sierra Club, 1995. This colorful book describes the life cyle and benefits of ladybugs.

Hepworth, Catherine. ***Antics! An Alphabetical Anthology***. The Putnam Publishing Group, 1996. The original alphabetical book has twenty-six illustrations accompanied by words containing the syllable ant, such as brillant, jubliant, and unpleasant.

Hopkins, Lee Bennett. ***Spectacular Science: A Book of Poems***. 1999. This book of colorful poems has many that relate to plants and the environment.

Hubbell, Sue. ***Broadsides From the Other Orders: A Book of Bugs***. Random House, 1993. This book provides general facts about numerous insects while placing insects into the scheme of life.

Related Literature

Imes, Rick. ***The Practical Entomologist***. Simon and Schuster, 1992. A practical information book and guide on insects.

Ingles, Lloyd G. ***Mammals of the Pacific States***. Standford Press, 1990. This easy-to use reference describes many mammals. Includes useful information on rodents.

Kneidel, Sally. ***Slugs, Bugs and Salamanders: Discovering Bugs in Your Garden***. Fulcrum Publishing, 2000. Emphasizes the role of insects and other animals in the garden.

Milne, Lorus and Margery**. *The Audubon Society Field Guide to North American Insects and Spiders***. Alfred A. Knopf, 1988. This is a useful book for identifying insects and includes numerous sketches, photographs and textual information.

Minor, Wendell. ***Grassroots—Poems by Carl Sandburg***. Browndeer Press, 1998. Fourteen poems with Midwestern themes or settings provide timeless observations about the heart of America. Illustrations add to the profound evocation of the sights and sounds of the Midwest.

Potter, Beatrix. ***The Complete Tales of Beatrix Potter***. F. Warne and Company, 1989. This book can be used to discuss how individuals in the story can be considered pests.

Starcher, Allison M. ***Good Bugs for Your Garden***. Alogonquin Books of Chapel Hill, 1998. This book is full of illustrations of "good bugs." Each figure is surrounded by important facts including size, eating habits, and life cycles.

Van Allsburg, Chris. ***Two Bad Ants***. Houghton Mifflin Co., 1988. These two ants get into a lot of trouble in a humorous adventure.

Weisner, David. ***June 29, 1999***. Clarion Books, 1992. While third grade classmates are sprouting seeds in paper cups, Holly has a more innovative science project in mind.

White, E.B. ***Charlotte's Web***. HarperCollins, Harper Trophy, 1999. Charlotte the spider, Wilbur the pig, and Fern a little girl, present a classic tale of life on a farm.

Winslow, Nancy and Joan R. Wright. ***Bugs***. William Morrow, 1988. Contains a lot of information about a variety of little creatures.

Wood, Don and Audrey. ***The Little Mouse, and the Red Ripe Strawberry, and the Big Hungry Bear***. Child's Play International Ltd., 1990. This rhyming story shows young children how feelings are involved with the love for certain fruits and vegetables.

Content Standards for California Public Schools Addressed in *What's Bugging You?*

Obtained from the California Department of Education*

Grade 4		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Science		
Life Sciences 2b	What a Pest! Quit Pestering Us! A New Pest is Discovered	Producers and consumers are related in food chains and food webs and may compete with each other for resources in an ecosystem.
Life Sciences 3	What a Pest!	Living organisms depend on one another and on their environment for survival.
Life Sciences 3a	What a Pest! Quit Pestering Us! A New Pest is Discovered	Ecosystems can be characterized by their living and nonliving components.
Life Sciences 3b	Quit Pestering Us! A New Pest is Discovered	In any particular environment, some kinds of plants and animals survive well, others survive less well, and some cannot survive at all.
Life Sciences 3c	Quit Pestering Us!	Many plants depend on animals for pollination and seed dispersal, and animals depend on plants for food and shelter.
Investigation and Experimentation 6b	Quit Pestering Us!	Can measure and estimate the weight, length, or volume of objects.
Investigation and Experimentation 6c	What a Pest!	Ability to formulate and justify predictions based on cause-and-effect relationships.
Reading/Language Arts		
Reading 1.0	Quit Pestering Us!	Students understand the basic features of reading. They select letter patterns and know how to translate them into spoken language by using phonics, syllabication, and word parts. They apply this knowledge to achieve fluent oral and silent reading.
Reading 1.1	Quit Pestering Us! Pest Poetry	Read narrative and expository text aloud with grade-appropriate fluency and accuracy and with appropriate pacing, intonation, and expression.
Reading 2.0	Quit Pestering Us!	Students read and understand grade-level-appropriate material. They draw upon a variety of comprehension strategies as needed.
Reading 2.2	Quit Pestering Us!	Use appropriate strategies when reading for different purposes.
Reading 2.6	Quit Pestering Us!	Distinguish between cause and effect and between fact and opinion in expository text.

Content Standard Details

Grade 4 *(continued)*

Standard	Lesson(s) in which Standard is Taught or Reinforced	Standard Description
Writing 1.0	What a Pest! Quit Pestering Us! A New Pest is Discovered	Write clear, coherent sentences in paragraphs that develop a central idea. Their writing shows they consider the audience and purpose. Students progress through the stages of the writing process.
Writing 1.1	Pest Poetry	Select a focus, an organizational structure, and a point of view based upon purpose, audience, length, and format requirements.
Writing 1.2	A New Pest is Discovered	Create multi-paragraph compositions that include introductory paragraphs, supporting information and concluding information.
Writing 1.3	What a Pest!	Use traditional structures for conveying information such as chronological order, cause and effect, similarity and difference.
Writing 1.4	A New Pest is Discovered	Write fluidly and legibly in cursive or jointed italic.
Writing 1.6	Pest Poetry	Locate information in reference texts by using organizational features.
Writing 1.7	Pest Poetry	Use various reference materials as an aid in writing.
Writing 1.10	Pest Poetry	Edit and revise selected drafts to improve coherence and progression by adding, deleting, consolidating, and rearranging text.
Writing 2.4	Quit Pestering Us!	Write summaries that contain the main ideas of the reading selection and the most significant details.
Written and Oral Language Conventions 1.0	What a Pest! Quit Pestering Us! Pest Poetry A New Pest is Discovered	Students write and speak with a command of standard English conventions appropriate to this grade level.
Written and Oral Language Conventions 1.1	What a Pest! Quit Pestering Us! A New Pest is Discovered	Use simple and compound sentences in writing and speaking.
Listening and Speaking 1.0	Quit Pestering Us! A New Pest is Discovered	Students listen critically and respond appropriately to oral communication. They speak in a manner that guides the listener to understand important ideas by using proper phrasing, pitch, and modulation.
Listening and Speaking 1.1	Quit Pestering Us!	Ask thoughtful questions and respond to relevant questions with appropriate elaboration in oral settings.
Listening and Speaking 1.2	What a Pest! Quit Pestering Us!	Summarize major ideas and supporting evidence presented in spoken messages and formal presentations.
Listening and Speaking 1.5	What a Pest! Quit Pestering Us! A New Pest is Discovered	Present effective introductions and conclusions that guide and inform the listener's understanding of important ideas and evidence.

Content Standard Details

Grade 4 *(continued)*

Standard	Lesson(s) in which Standard is Taught or Reinforced	Standard Description
Listening and Speaking 1.6	What a Pest! Quit Pestering Us! A New Pest is Discovered	Use traditional structures for conveying information.
Listening and Speaking 1.7	What a Pest! A New Pest is Discovered	Emphasize points in ways that help the listener or viewer to follow important ideas and concepts.
Listening and Speaking 1.8	What a Pest!	Use details, examples, anecdotes, or experiences to explain or clarify information.
Listening and Speaking 1.9	What a Pest!	Use volume pitch, phrasing, pace, modulation, and gestures appropriately to enhance meaning.
Listening and Speaking 2.0	A New Pest is Discovered	Students deliver brief recitations and oral presentations about familiar experiences or interests that are organized around a coherent thesis statement.
Listening and Speaking 2.1	A New Pest is Discovered	Make narrative presentations.
Listening and Speaking 2.3	Quit Pestering Us!	Deliver oral summaries of articles and books that contain the main ideas of the event or article and the most significant details.
Listening and Speaking 2.4	Pest Poetry	Recite brief poems, soliloquies, or dramatic dialogues, using clear diction, tempo, volume, and phrasing.

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Content Standard Details

Grade 5		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Science		
Earth Sciences 4c	Quit Pestering Us!	Know the causes and effects of different types of severe weather.
Investigation and Experimentation 6a	What a Pest!	Classify objects in accordance with appropriate criteria.
Reading/Language Arts		
Reading1.0	Quit Pestering Us!	Students use their knowledge of word origins and word relationships to determine the meaning of specialized vocabulary and to understand the precise meaning of grade-level-appropriate words.
Reading 1.1	Quit Pestering Us! Pest Poetry	Read aloud narrative and expository text fluently and accurately and with appropriate pacing, intonation, and expression.
Reading 1.5	Pest Poetry	Understand and explain the figurative and metaphorical use of words in context.
Reading 2.3	Quit Pestering Us!	Discern main ideas and concepts presented in texts, identifying and assessing evidence that supports those ideas.
Reading 2.4	Quit Pestering Us!	Draw inferences, conclusions, or generalizations about text and support them with textual evidence and prior knowledge.
Reading 3.1	Pest Poetry	Identify and analyze the characteristics of poetry, drama, fiction, and nonfiction.
Reading 3.5	Pest Poetry	Describe the function and effect of common literacy devices.
Writing 1.0	What a Pest! Quit Pestering Us! A New Pest is Discovered	Students write clear, coherent, and focused essays. The writing exhibits the students' awareness of the audience and purpose.
Writing 1.2	A New Pest is Discovered	Create multiple-paragraph narrative compositions.
Writing1.3	Pest Poetry	Use organizational features of printed text to locate relevant information.
Writing 1.4	Pest Poetry	Create simple documents by using electronic media and employing organizational features.
Writing 1.6	Pest Poetry A New Pest is Discovered	Edit and revise manuscripts to improve the meaning and focus of writing by adding, deleting, consolidating, clarifying, and rearranging words and sentences.

Grade 5 *(continued)*

Standard	Lesson(s) in which Standard is Taught or Reinforced	Standard Description
Written and Oral Language Conventions 1.0	What a Pest! Quit Pestering Us! Pest Poetry A New Pest is Discovered	Students write and speak with a command of standard English conventions appropriate to fifth grade.
Listening and Speaking 1.0	Quit Pestering Us! Pest Poetry A New Pest is Discovered	Students deliver focused, coherent presentations that convey ideas clearly and relate to the background and interests of the audience. They evaluate the content of oral communication.
Listening and Speaking 1.1	Quit Pestering Us!	Ask questions that seek information not already discussed.
Listening and Speaking 1.3	What a Pest! Quit Pestering Us!	Make inferences or draw conclusions based on an oral report.
Listening and Speaking 1.4	What a Pest! Quit Pestering Us! Pest Poetry A New Pest is Discovered	Select a focus, organizational structure, and point of view for an oral presentation.
Listening and Speaking 1.5	What a Pest! Quit Pestering Us! Pest Poetry A New Pest is Discovered	Clarify and support spoken ideas with evidence and examples.
Listening and Speaking 1.6	What a Pest! Pest Poetry	Engage the audience with appropriate verbal cues, facial expressions, and gestures.
Listening and Speaking 2.2	Quit Pestering Us! A New Pest is Discovered	Deliver informative presentations about an important idea, issue, or event.

Content Standard Details

Grade 6		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Science		
Ecology 5	Quit Pestering Us!	Organisms in ecosystems exchange energy and nutrients among themselves and with the environment.
Ecology 5c	What a Pest! Quit Pestering Us! A New Pest is Discovered	Populations of organisms can be categorized by the functions they serve in an ecosystem.
Ecology 5d	What a Pest! Quit Pestering Us! A New Pest is Discovered	Different kinds of organisms may play similar ecological roles in similar biomes.
Ecology 5e	Quit Pestering Us! A New Pest is Discovered	The number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water, a range of temperatures, and soil composition.
Reading/Language Arts		
Reading 1.0	Quit Pestering Us!	Students use their knowledge of word origins and word relationships, as well as historical and literary context clues, to determine the meaning of specialized vocabulary and to understand the precise meaning of grade-level-appropriate texts.
Reading 1.1	Pest Poetry	Read aloud narrative and expository text fluently and accurately and with appropriate pacing, intonation, and expression.
Reading 1.4	Quit Pestering Us!	Monitor expository text for unknown words or words with novel meanings by using word, sentence, and paragraph clues to determine meaning.
Reading 2.0	Quit Pestering Us!	Students read and understand grade-level-appropriate material. They describe and connect the essential ideas arguments, and perspectives of the text by using their knowledge of text structure, organization and purpose.
Reading 2.2	Quit Pestering Us!	Analyze text that uses the compare-and-contrast organizational pattern.
Reading 2.3	Quit Pestering Us!	Connect and clarify main ideas by identifying their relationships to other sources and related topics.
Reading 2.4	Quit Pestering Us!	Clarify an understanding of texts by creating outlines, logical notes, summaries, or reports.
Writing 1.0	Quit Pestering Us! A New Pest is Discovered	Students write clear, coherent, and focused essays with the awareness of audience and purpose.

Grade 6 *(continued)*

Standard	Lesson(s) in which Standard is Taught or Reinforced	Standard Description
Writing 1.1	Pest Poetry	Choose the form of writing that best suits the intended purpose.
Writing 1.2	A New Pest is Discovered	Create multiple-paragraph expository compositions.
Writing 1.3	Quit Pestering Us!	Use a variety of effective and coherent organizational patterns, including comparison and contrast, organization by categories, and arrangement by spatial order, order of importance, or climactic order.
Writing 1.4	Pest Poetry	Use organizational features of electronic text to locate information.
Writing 1.6	A New Pest is Discovered	Revise writing to improve the organization and consistency of ideas within and between paragraphs.
Written and Oral Language Conventions 1.0	What a Pest! Quit Pestering Us! Pest Poetry A New Pest is Discovered	Students write and speak with a command of standard English conventions appropriate to this grade level.
Written and Oral Language Conventions 1.1	A New Pest is Discovered	Use simple, compound, and compound-complex sentences; use effective coordination and subordination of ideas to express complete thoughts.
Written and Oral Language Conventions 1.4	A New Pest is Discovered	Use correct capitalization.
Listening and Speaking 1.0	Quit Pestering Us! Pest Poetry A New Pest is Discovered	Students deliver focused coherent presentations that convey ideas clearly and relate to the background and interests of the audience. They evaluate the content of oral communication.
Listening and Speaking 1.1	What a Pest! Pest Poetry	Relate the speaker's verbal communication to the nonverbal message.
Listening and Speaking 1.2	Pest Poetry	Identify tone, mood, and emotion conveyed in the oral communication.
Listening and Speaking 1.4	What a Pest! A New Pest is Discovered	Select a focus, an organizational structure, and a point of view, matching the purpose, message, occasion, and vocal modulation to the audience.
Listening and Speaking 1.5	What a Pest! A New Pest is Discovered	Emphasize salient points to assist the listener in following the main ideas and concepts.
Listening and Speaking 1.6	Quit Pestering Us! A New Pest is Discovered	Support opinions with detailed evidence and with visual media displays that use appropriate technology.
Listening and Speaking 1.7	What a Pest! Quit Pestering Us!	Use effective rate, volume, pitch, and tone and align nonverbal elements to sustain audience interest and attention.

Content Standard Details

Grade 6 *(continued)*		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Listening and Speaking 1.8	Pest Poetry	Analyze the use of rhetorical devices for intent and effect.
Listening and Speaking 2.2	A New Pest is Discovered	Deliver informative presentations.
Listening and Speaking 2.5	Quit Pestering Us!	Deliver presentations on problems and solutions.
History-Social Science		
World History and Geography: Ancient Civilizations 6.1.3	Quit Pestering Us!	Discuss the climatic changes and human modifications of the physical environment that gave rise to the domestication of plants and animals and new sources for clothing and shelter.

* For a complete listing of the Content Standards for California Public Schools, contact CDE Press, Sales Office, California Department of Education, Post Office Box 271, Sacramento, CA 95812-0271; (916) 445-1260; www.cde.ca.gov.

California Foundation For Agriculture In The Classroom

Glossary

Abdomen: In insects, the last segment of the body.

Aphid: A small green insect that sucks the liquid out of plants with its proboscis (mouth).

Beneficial: Helpful.

Biodegradable: Capable of breaking down or decomposing in the environment.

Biological Control: The use of natural enemies and biotechnology (including predators, parasites, pathogens, competitors) to contain or control pests.

Bug: An insect with a sucking mouth part, belonging to the "True Bug Family."

Chemical: A combination of elements such as carbon, hydrogen or oxygen; can be natural or manufactured; everything is made of chemicals.

Control: To restrain or regulate.

Disease: Any disturbance that interferes with a plant's normal structure, function, or economic value.

Ecosystem: The network of living and non-living things in a particular community, which includes plants, animals, microbes, soil, and air.

Entomology: The branch of zoology that studies insects.

Environment: The surroundings of a particular organism.

Eradicate: To rid of completely.

Fungicide: A chemical used to destroy fungi such as molds and mildew.

Fungus: A group of decomposers that lack chlorophyll; they reproduce with spores; examples include mold, mildew, and mushrooms.

Glassy-winged Sharpshooter: A flying insect almost ½ inch long that got its name because it has large transparent wings with reddish veins; excretes a watery substance; a potential carrier of the bacterium that causes Pierce's disease.

Glossary

Habitat: The region or area where a plant or animal naturally lives.

Harmful: Causing injury or damage.

Head: The top portion of an insect's body that contains the head, antennae, and other sensory organs.

Herbicide: A chemical that kills plants.

Host: An organism which provides nourishment or shelter for a parasite.

Insect: An air-breathing animal which has a distinct head, thorax, abdomen, and three pairs of legs.

Insecticidal Soap: A soap used to kill insects.

Insecticide: A chemical used to destroy insects.

Integrated Pest Management (IPM): An ecological and scientific approach to long-term pest suppression that utilizes multiple disciplines and a combination of controls, such as beneficial insects, cultural practices, mechanical devices, and chemical inputs.

Larva: An immature insect that hatches from an egg and passes through a pupal stage before becoming an adult, such as a caterpillar or maggot.

Lygus Bug: A specific insect with sucking mouth parts which feeds on plants such as weeds, strawberry plants, and lettuce.

Manage: To control within reason.

Mediterranean Fruit Fly: A specific fly that deposits its eggs into ripe or ripening fruit.

Mite: In the spider or tick class, arachnid, usually small (1 to 3 mm long) with eight legs.

Natural Enemies: The organisms that prey on or compete with other organisms, thereby limiting its population. Certain natural enemies are also known as beneficial insects.

Nymph: A young developmental stage of an insect.

California Foundation For Agriculture In The Classroom

Glossary

Organism: Any living thing, including plants, animals, fungi, bacteria, viruses, and protozoa.

Parasite: An organism that harms others while benefits itself.

Pathogen: Any disease-producing organism.

Pest: Any organism that is destructive to animals, cultivated plants, stored food, etc.

Pest Management: Various methods used to control pests.

Pesticide: A chemical used to destroy unwanted organisms such as insects, weeds, and rodents.

Pheromone: A substance secreted by an organism that affects the behavior or development of other organisms of the same species.

Pierce's Disease: A disease caused by a bacterium *Xylella fastidiosa*. This bacteria enters the plant stem and continues to grow and eventually chokes the plant's water and nutrient transport system and causes the plant to die.

Predator: An animal which kills other animals for food. Some insects are predators.

Proboscis: An elongated mouth part of certain insects used for sucking.

Pupa: A non-feeding, inactive stage in which the tissues of an insect larva are reorganized into those of an adult.

Red Imported Fire Ant: A reddish brown social insect, not native to the United States, that can give a burning sting from the stinger on its abdomen. They have an extremely agressive behavior and produce mounds of soft, crumbly soil that contain their colonies.

Rodent: A mammal with strong front teeth used for gnawing.

Rodenticide: A chemical used to destroy rodents.

Shelter: Something that serves as a barrier or shield against attack, danger, or weather.

Slug: A small, slimy animal related to the snail, but without a shell.

Glossary

Snail: A soft-bodied animal, a mollusk, with a shell that can enclose its whole body.

Spider: An arachnid; has two main body parts and eight legs.

Survival: To continue to live or exist.

Thorax: The middle body region of an insect to which legs and wings are attached.

Toxic: Poisonous.

Trap: A devise for trapping and holding animals.

Weed: A plant growing where it is not wanted.