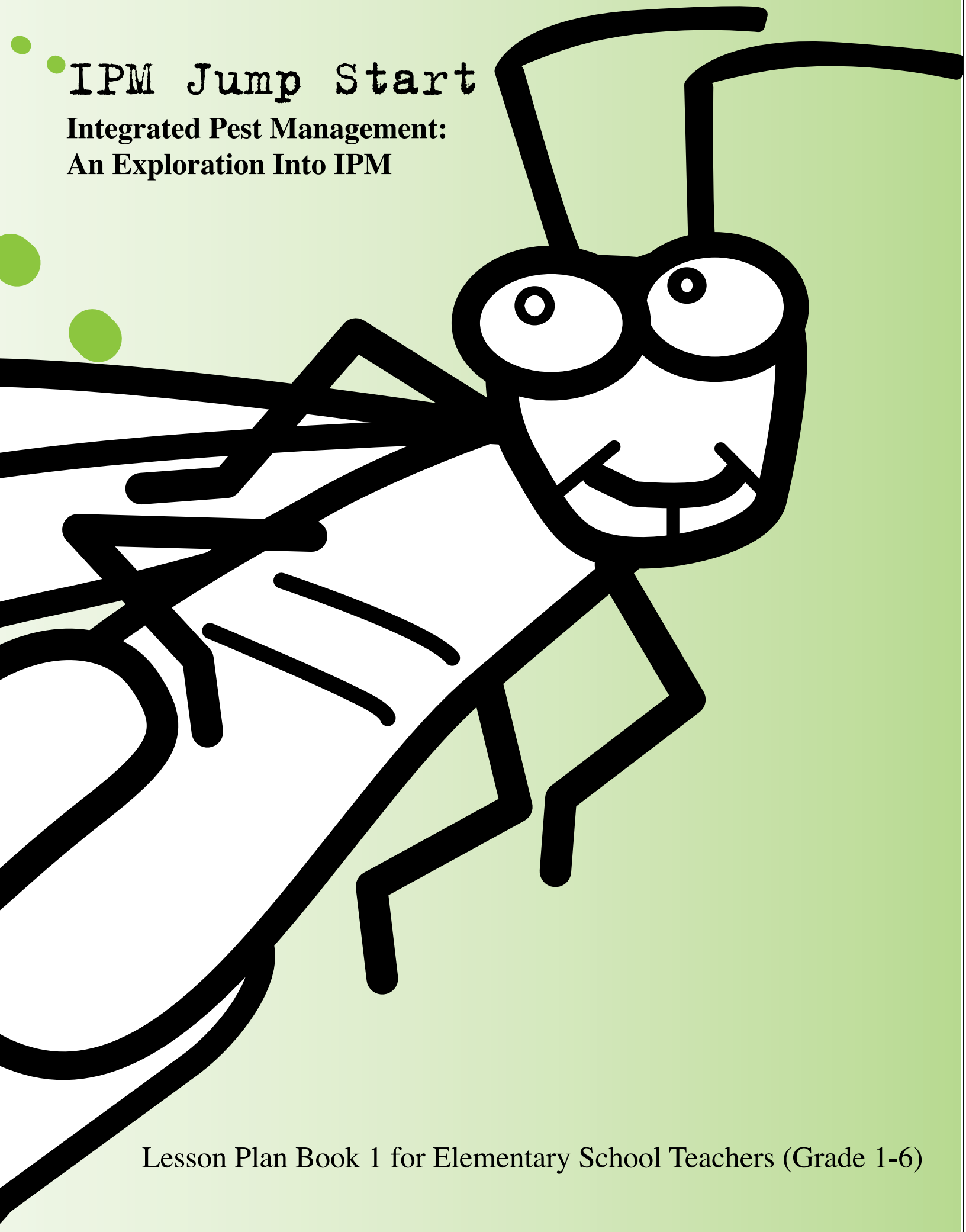
IPM Jump Start

Integrated Pest Management:
An Exploration Into IPM



Lesson Plan Book 1 for Elementary School Teachers (Grade 1-6)

IPM Collaborators

Pennsylvania Contributors Include:

- Patricia Vathis, Environmental and Ecology Curriculum Advisor, Pennsylvania Department of Education
- Lyn Garling, Education Specialist, PA IPM
- Amber Gray, IPM Curriculum Development Assistant, PA IPM
- Kristie Auman-Bauer, Public Relations and Outreach Coordinator, PA IPM
- Ed Rajotte, PA IPM Coordinator/Penn State
- Laird Design and Graphic Services: Tom Laird and Garo Goodrow

"IPM Jump Start" is a resource for PA teachers of grades K-6 to teach **Pennsylvania Academic Standards in Environment and Ecology**, section 4.5.4 "Integrated Pest Management (IPM)". For more academic standard information, see the back cover and visit http://pde.state.pa.us.

The Pennsylvania State Assessment Test will assess proficiency in the Science and Technology Standards as well as Environment and Ecology Standards for students in grades 4, 8, and 11. It is imperative that quality standards-based materials be available to our schools. The Department of Education's Office of Environment and Ecology endorses these materials for teachers to use in helping to meet the standard areas of Integrated Pest Management, Ecosystems and Their Interactions, and Environmental Health.

PA IPM Collaborators in Education

The PA IPM Program is a collaboration between Penn State College of Agriculture and the Pennsylvania Department of Agriculture. Additionally, signatories to a Memorandum of Understanding collaboratively promote IPM education in schools including IPM curriculum and implementation. Collaborators include Penn State Colleges of Agricultural Sciences and Education and the Pennsylvania Departments of Education; Health; Agriculture; Environmental Protection; and Conservation and Natural Resources. For more information, visit the PA IPM web site at http://www.paipm.org.

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This publication is available for download at **PAIPM.ORG**

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As an educator, being expected to teach something you may be unfamiliar with can be intimidating, difficult and overwhelming. As Pennsylvania adopts new education standards, many educators are being put in this type of situation, especially when asked to teach ***Integrated Pest Management (IPM)***. IPM is a scientifically-based decision-making process that incorporates a variety of technological and management tactics to achieve long-term, environmentally sound pest suppression. Basically, it's common-sense pest control. Although IPM is usually taught in the science classroom, it lends itself very well to other disciplines including social studies, reading, math, history, and economics. Having a basic understanding of IPM and how to incorporate it into a learning environment can benefit all educators, regardless of the discipline taught.

To begin understanding IPM, consider each term individually. "Integrate" means to bring multiple parts together into a unified whole. A "pest" is an organism that humans feel is in an undesirable location. "Management" refers to controlling or handling a pest problem, not necessarily exterminating the pest population. So, IPM involves using a variety of tactics to keep a pest organism at an acceptable population level, at a specific location.

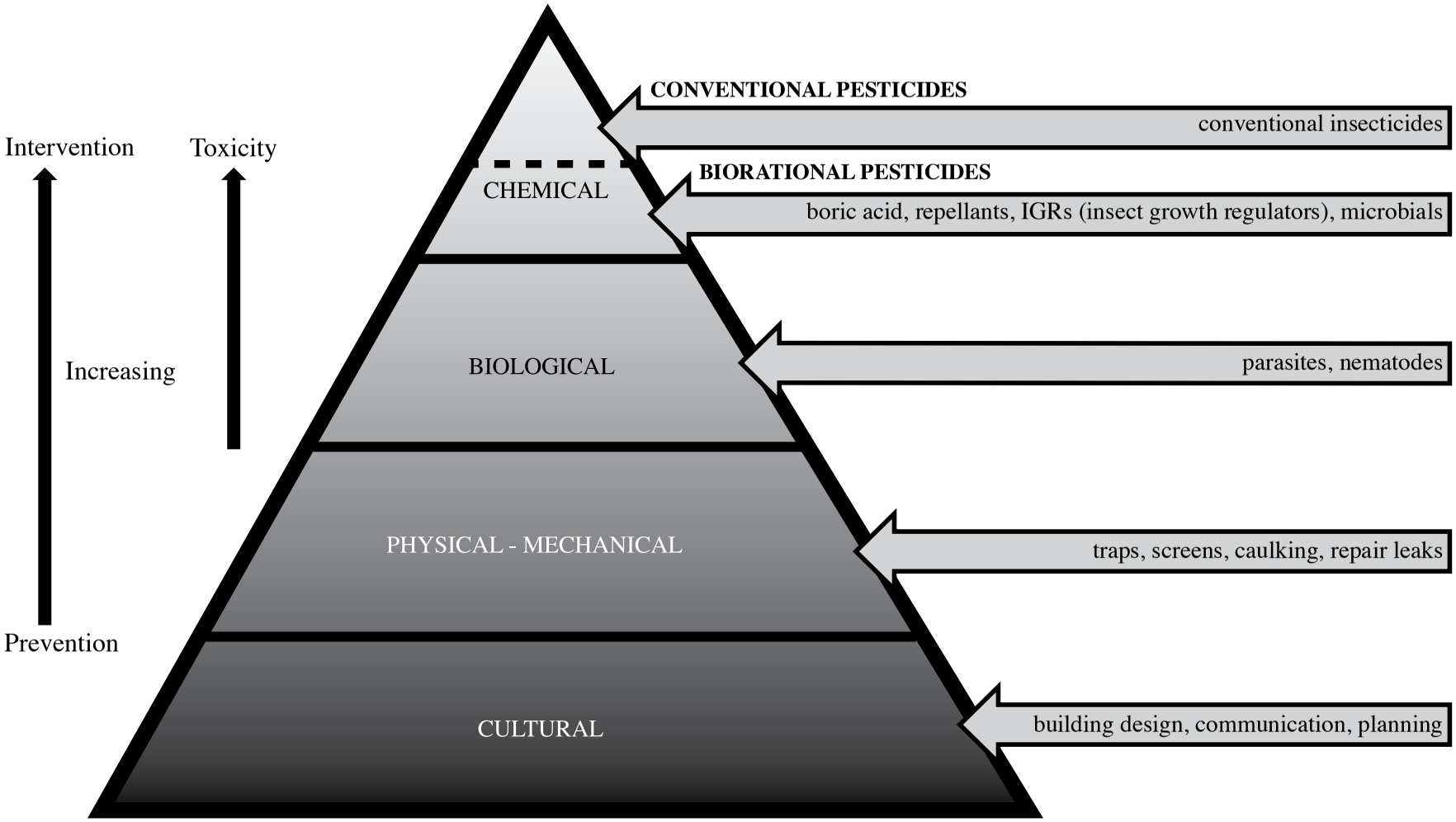
Six Steps of Integrated Pest Management

1. Properly identify the pest.
2. Understand the biology of the pest and the host.
3. Monitor the environment to determine pest levels.
4. Determine the ***action threshold***.
5. Choose tactics.
6. Evaluate the results.

When a pest is sighted, it doesn't automatically mean treatment is necessary. The six steps of IPM help determine if there is truly a pest problem, and if so, the pyramid of tactics provides insight on how to treat the problem.

In the pyramid on the following page, the colors black or dark gray (green in color copies) indicate the safer levels of treatment and the tactics that should be tried first before advancing up the pyramid. As you move up the pyramid the color becomes light gray (red in color copies) indicating you should stop and evaluate the tactic that's going to be used, read all labels properly, and have adult supervision if applicable. Additionally, there are two arrows on the left of the pyramid. The one closest to the pyramid indicates the level of ***toxicity***, which increases while moving up the pyramid. The **conventional** chemicals are the most toxic tactics available when combating pests, while the **cultural** tactics are not toxic. The second arrow along the left side shows **prevention** verses **intervention**. As you move up the pyramid and the tactics increase in toxicity, the pest situation is often times to the point of intervention, not prevention. A key component to Integrated Pest Management is to incorporate tactics that will prevent pests from becoming a problem.

IPM is not a difficult concept to understand, and it relates to everyone. Every person has had experience at one time or another with some sort of pest. Many people already use IPM to prevent or manage pests and don't even realize it. Whether it's cleaning up crumbs on the counter, removing water sources, using a fly swatter, setting a mouse trap, or closing the screen door, it's all IPM. Using science and technological advancements to find safer, less toxic ways to prevent and manage pests is vital to maintaining human and environmental health. Individuals have the responsibility to make wise, educated decisions when managing pests, because the decision of one person will affect many.



Pyramid of IPM Tactics for Inside Buildings

What Is A Pest?

A rabbit can make a wonderful pet, but can also cause problems in a garden by eating the lettuce. Should the rabbit be considered a ***pest***? This activity is designed to bring up questions in a group setting and allow the participants to clarify what, when, where and why a certain organism is or is not considered a pest.

Suggested Level(s):
Grades K-6
Adaptable for other grades

Subject(s):
Environment & Ecology,
Math, Arts & Humanities

Standards:
Environment & Ecology
4.5: Integrated Pest Management (IPM)

Math
2.2: Computation and Estimation

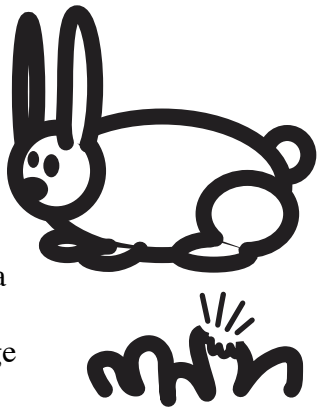
Arts & Humanities
9.1: Production, Performance & Exhibition of Dance, Music, Theatre, & Visual Arts

Skills:
Critical thinking, Integrating, Discussing, Presenting, Comparing and contrasting, Classifying

Technology Connection:
Digital camera, software & printer to print pictures from camera

Materials:
- Pencil/Pen
- Paper
- Overhead or white board

Time Consideration:
Preparation: 5-10 minutes
Activity: 30-50 minutes



Objective(s):

Students will...
- understand and be able to explain that "pest" is a human construct rather than a "natural" category
- explore the wide range of organisms that can potentially be "pests"
- compare and contrast the different roles organisms have besides pestering humans
- discuss varying points of view on when a certain organism is and is not a pest
- describe how management of a particular organism will depend upon a person's perspective

Assessment Opportunities:

Either assign or have students choose an organism from the class list of pests. Instruct students to draw two detailed pictures: the first picture with the organism in an environment where it is considered a pest and the second picture with the organism in an environment where it is not considered a pest. Using the completed drawings, have the students answer the following questions in their own words:
- What are the similarities between the two pictures?
- What are the differences between the two pictures?
- Do you consider this organism a pest? Why and/or why not?
- How would you deal with this pest if it became a problem in your environment?

Background:

Everyone knows what a pest is, right? Or do they? Whether or not an organism is considered to be a pest depends on the situation, a person's point of view and other "non-scientific" factors.

What Is A Pest?

Consider this statement. If there were no humans on earth, there would be no "pests". Or would there? Differing opinions about pest status often lead to controversy in private and public life about what to do about the "pest problem" at hand.

Getting Ready:

All students should have a writing implement and paper. An overhead or white board can be used to record class information.

Doing the Activity:

1. Form **small groups of 4-5 students**, each with a piece of paper. Write at the top of the paper:

Organism	Is a pest when:	Is not a pest when:

2. Students silently spend 5-10 minutes writing down the name of any organism they think might be a pest in the left-hand column. Write when or where it is a pest under the "Pest" column. List a situation when or where that SAME organism is NOT a pest in the far right-hand column.

Organism	Is a pest when:	Is not a pest when:
Raccoon	in the garbage can	in the woods

3. Within each group, compare notes by going around the table and each student reading his/her answers. The first student to read his/her answers will be the **group recorder** and will add each new organism mentioned to his/her list to create a master list. The group recorder will also note how many times the same organism(s) was mentioned (e.g. 4 out of 5 students in the group said mosquitoes).

4. Choose a **reporter** for each group to present the group's list of organisms to the class. Have a student write on the board all the organisms mentioned by the class and count the duplicate responses (e.g. 3 out of 6 groups mentioned house flies). If there were different opinions within a group about whether a specific organism is considered a pest, have students present the different perspectives to the class.

5. Examine the "pest" column listing all the organisms mentioned by the class. How many times was each organism mentioned? Are these organisms typically referred to as annoying by humans?

6. Discuss the situations in which the organisms were listed as a "pest." What do these situations have in common? Are they human endeavors of some sort or spoiling something that humans' value?

7. Discuss the situations in which the organisms were listed as "not a pest." What do these situations have in common? Are they a role played by the species in the natural environment and/or their use as food, pleasure or research purposes for humans?

8. Brainstorm as a class:
   - Should potential pests be treated the same wherever they occur? Why or why not?
   - Is there a way we can now define when an organism is and is not a pest? How?

Enrichment Activities:

1. Using the class information on the board, have students:
   - Rank the "Top five pests according to Mr./Ms. Smith's class."
   - Calculate the percent of the time specific pests were mentioned (e.g. 3 out of 6 groups mentioned "ants" as a pest = 50 percent of the groups mentioned "ants" as a pest).
   - Calculate how many different types of species are represented in the list (mammals, birds, plants, reptiles, etc.).

2. Have each student write the name of one organism they consider to be a "pest" on a half of a 3x5 index card for as many pest organisms they can think of. In small groups instruct students to classify the various organisms by similarities, habitat, ***biome***, ***ecosystem***, or by ***taxonomy***, etc.

Science & Technology Standard 3.3 Biological Sciences

3. Have students use a digital camera to take pictures of pest organisms they find in and around their school and home environments. Use the photographs to create a bulletin board showing pest species in different environments. On the bulletin board, divide the pictures showing in which environments an organism is considered a pest and in which environments they are not.

For Younger Students:

1. Instead of writing the names of pest organisms on paper, turn this into a class discussion. Ask students to name pest organisms and when they may not be considered pests. Write the answers on the board. Choose several of the organisms listed to learn more about. Discuss the questions listed under Assessment Opportunities. Have students draw and color pictures of their favorite organisms and decide if they consider them to be pests.

Reading Connection:

Depending on how it is used in the classroom, the following book can address PA Reading, Writing, Speaking, and Listening Standard 1.1: Learning to Read Independently and Standard 1.2: Reading Critically in All Content Areas.

- Pallotta, Jerry. *The Icky Bug Alphabet Book*. Charlesbridge Publishing. 1986.

This is a book that uses insects and other arthropods to convey the letters of the alphabet. Organisms included may or may not be described as pest species. Grades K-3.
ISBN: 0-88106-450-5

Project notes:

Lyn Garling, with the PA IPM Program at the Pennsylvania State University, developed "*What is a Pest*".

Mouthpart Madness

Understanding the basic biology of a pest is a key component to implementing proper Integrated Pest Management (IPM) techniques to manage that pest. In this activity students will explore the four major kinds of ***insect*** mouthparts and apply that knowledge to devising management techniques.

Suggested Level(s):
Grades 3-5
Adaptable for other grades

Subject(s):
Environment & Ecology,
Arts & Humanities

Standards:
Environment & Ecology
- 4.5: Integrated Pest Management (IPM)
- 4.6: Ecosystems and Their Interactions

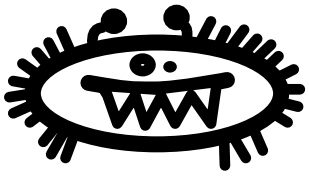
Arts & Humanities
- 9.1: Production, Performance & Exhibition of Dance, Music, Theatre, & Visual Arts

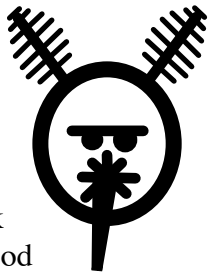
Skills:
Critical thinking, Participating, Discussing

Technology Connection:
Internet resources, Digital camera

Materials:
- (2) paper plates
- Crackers
- Peanut butter
- Honey, jelly, or pudding
- Straw cut in half
- Small soft drink cups with lids and slits for straws
- Long-necked, wide-mouth bottle
- Soft rubber or plastic tubing (long enough to reach bottom of bottle)

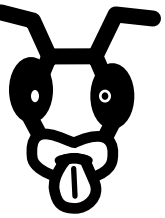
Time Consideration:
Preparation: 10 minutes
Activity: 20 minutes





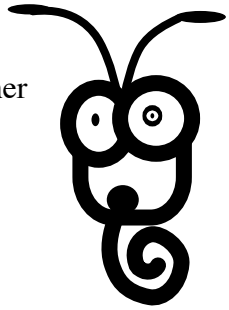
Objective(s):

Students will...
- identify the four major kinds of insect mouthparts and explain how they work
- examine how specific mouthparts can limit food resources and in what ***niche*** an organism can survive
- apply insect biology, specifically mouthparts and feeding habits, to pest management techniques



Assessment Opportunities:

- Students can research and build an anatomically correct insect using various materials. Younger students can paint a rock to look like an insect. Set up specific requirements for the project. Possible guidelines:
- Model must represent an actual insect or other arthropod
- Model must be accurate in shape, color, anatomy, and proportions
- Write a description of the insect and include
  - The common name of the insect
  - Where it's found (geography)
  - A description of its habitat and what it eats
  - When and why this insect may be considered a pest or descride when and why it's not considered a pest
  - An explaination of IPM tactics that can be used to manage this pest



Some of these guidelines were taken from Pennsylvania State University's Build-a-Bug contest rules. Go to **http://entscied.cas.psu.edu/Fair.html** for more information on entering this contest. Or you can hold your own!

Background:

The old adage "you are what you eat" takes on a different twist with insects. When ***arthropods*** came on the scene, the main new ***adaptation*** they had was jointed appendages, including the complex workings of the insect mouth. This was very different from their worm-like ancestors. The same basic moveable pieces of machinery that make up the insect mouth have been modi-

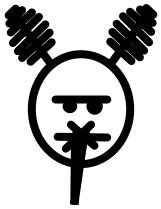
Mouthpart Madness

fied in several key ways to allow the insects to specialize on certain food types. Consequently, if a certain type of damage is present on a leaf, whole groups of insects are either implicated or exonerated.

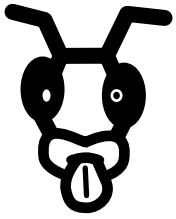
There are four basic types of insect mouthparts: chewing, piercing/sucking, sponging/lapping, and siphoning. There are also some adult insects, such as the mayfly, which do not have any mouthparts because they don't feed as an adult.

• The chewing mouthpart can rip, bite, and tear food. Examples of insects with chewing mouthparts include caterpillars, cockroaches, ants, and grasshoppers.

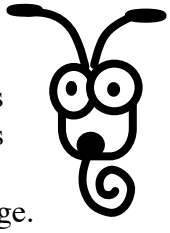
• Piercing/sucking mouthparts work like a syringe. They are long tubes that are pierced into plant or animal tissue and suck out fluid or blood. Insects with this type of mouthpart include aphids and mosquitoes.



• The next type of mouthpart is the sponging/lapping mouthpart. The housefly is a common insect pest with this mouthpart. They extend a tongue-like structure to the surface and lap up or absorb the liquid like a sponge. Sometimes the food source is not liquid so the insect first spits on the food to make it liquid and then laps it up.



• Siphoning is the final basic type of mouthpart, and it works like a straw. Moths and butterflies siphon up nectar from flowers. As some organisms go through their life cycles, their mouthparts change. For example, the ***larval stage*** of a butterfly is a caterpillar, which has chewing mouthparts, different from the adult stage. The two stages occupy different ecological niches in an ecosystem.



An ecological ***niche*** can be defined as the location and role or job for which a species is well suited within its community, including its habitat, what it eats, its activities, and its interactions with other living things. Different species can compete for the same niche, but will not occupy the exact same niche for very long. For example, a mammal, bird or insect may compete for the same flower resource, nectar. Each organism can extract the nectar successfully because of special adaptations. Not all organisms can occupy this particular niche for various reasons, including feeding methods. When dealing with pest species such as insects, it is important to understand the biology and life cycle of the organism and to know what niche it occupies when designing an appropriate IPM plan.

Getting Ready:

1. Set the following items out on a table:
   - small cup containing water with "to-go" lid (fill with enough water for the straw to reach it)
   - one long-necked bottle with a little water in the bottom
   - one paper plate with honey, jelly, or pudding on it
   - one paper plate with peanut butter holding a cracker up on edge
   - other various "cups" (if available) with different levels of water in them, some open, some with different lids with slits or holes

Doing the Activity:

1. Select four volunteers to form the insect team.
2. Instruct each person to put their hands behind their back. Hands cannot be used in this activity.
3. Assign each person an insect type and the associated mouthpart. Hand out the straw and tubing accordingly. (Additional pests and items can be added at the teacher's discretion)

Mouthpart Madness

Insect	Type of mouthpart	Use in activity
Caterpillar	Chewing	only use teeth
Squash bug	Piercing/sucking	only use straw
Housefly	Sponging/lapping	only use tongue
Butterfly	Siphoning	only use tubing

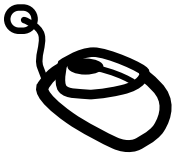
4. Instruct the team to go after the kind of food they can eat on the table in front of them. Remember, no hands!!

5. Ask the "insects" questions as they are trying to get to the food sources: "Housefly, can you eat leaves?" (The cracker stuck in the peanut butter represents a leaf) "Caterpillar, can you drink nectar from a flower?" (The water inside the cups and bottles represents nectar). "Squash bug and butterfly, can you feed from the same source as the other insects?"

6. Discuss with students how knowing the mouthpart of an insect can help with finding the correct IPM tactics to use if the insect is considered a pest. Points to emphasize:

- By looking at the damage on a plant, determine the type of mouthpart that could cause the damage. This can eliminate or implicate specific insect groups. *Proper identification of the pest is the first step in IPM!*
- If in the IPM plan it is decided to apply an insecticidal soap or other ***pesticide***, will it affect the pest? For example, if you apply a chemical on the leaf surface that will kill an insect only when the leaf is eaten, it won't affect an insect with a piercing/sucking mouth part. Why not? So not only was the pest not managed, but the chemical may kill beneficial insects with chewing mouthparts occupying that niche.

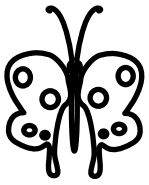
Enrichment Activities:



1. Take students outside and around the school property to look for evidence of pests and damage to plants. Collect various leaves exhibiting damage and decipher what type of mouthpart could have caused the damage. Observe the surroundings where the plant was collected to see if there are any insects that may be the cause of the damage. Use a digital camera to record the findings. If you cannot take students outside, bring in a collection of damaged plant parts inside the classroom for study and research possible culprits of the damage. Discuss what else besides insects might cause leaf damage.

For Younger Students:

1. Limit the number of mouthparts being studied to chewing mouthparts and siphoning mouthparts. Allow students to practice "eating" with these two mouthpart types. Purchase caterpillars, such as Painted Lady caterpillars and have students observe the eating patterns of the caterpillars. Eventually the caterpillars will enter the ***pupal stage*** and emerge as Painted Lady Butterflies, which have siphoning mouthparts. Students can observe the butterfly mouthparts before releasing them into the wild by feeding the butterflies homemade nectar such as a sugar water.



Reading Connection

Depending on how they are used in the classroom, the following books can address PA Reading, Writing, Speaking, and Listening Standard 1.1: Learning to Read Independently and Standard 1.2: Reading Critically in All Content Areas.

- Hickman, Pamela. *Starting with Nature: Bug Book*. Kids Can Press. 1999.

This book introduces students to a variety of common insects found in the United States. Includes several insect activities. Grades 3-6. ISBN: 1-55074-653-7.

- Whalley, Paul. *Eyewitness Books: Butterfly & Moth*. Dorling Kindersley Limited. 1988.

This book provides an in-depth look at the life cycle and behaviors of many butterfly and moth species. Pictures are excellent. Grades 4-8. ISBN: 0-394-89618-1.

Lyn Garling with the PA IPM Program at the Pennsylvania State University developed "*Mouthpart Madness*".

To Catch A Mouse...

Integrated Pest Management (IPM) involves understanding pest behavior so a less-toxic, preventative strategy for control can be implemented. For rodent pests such as mice and rats, the commonly used poisonous baits called "rodenticides," are actually highly ***toxic*** to all mammals and birds. Physically removing rodents is a much safer tactic, but what are the best ways to catch a mouse in the house? Should you get a cat or set a trap? If you set a trap, what direction should it face to successfully catch the mouse? Students use observations and data collection to explore mouse behavior and determine the best way to set a trap to catch a mouse.

Suggested Level(s):
Grades 2-6

Subject(s):
Science and Technology, Environment & Ecology, Math

Standards:

Science and Technology
- 3.2 Inquiry and Design

Environment and Ecology
- 4.5: Integrated Pest Management (IPM)

Math
- 2.2 Computation and Estimation
- 2.6 Statistics and Data Analysis

Skills:
Observing, Data collecting, Interpreting and Applying data, Graphing

Technology Connection:
Internet resources, Graphing programs

Materials *(per class or group)*:
- (1) Terrarium with a lid or cardboard box (14" x 20" and 15" deep)
- (1) Piece of blank paper cut exactly to fit the bottom of the terranium or box
- (1) Ruler or meter stick
- (1) Black marker
- (1) Mouse
- (1) Clock with second hand
- Various types of mousetraps, including a snap trap
- Pencil and Data sheet

Time Consideration:
- Preparation: 10 minutes
- Activity: 30-45 minutes (includes graphing time)

Objective(s):

Students will...
- conduct an experiment by observing, collecting and analyzing behavioral data
- write a ***hypothesis*** before beginning the experiment and then accept/reject the hypothesis based on data collected
- apply knowledge of mouse behavior gained from the experiment to propose appropriate IPM tactics to managing mouse infestations

Assessment Opportunities:

Instruct students to design and run their own experiment using the mouse/mice to learn more about mouse behavior. Sample ideas include:
- What diameter tunnel do mice prefer to travel through?
- What food sources do mice prefer?
- How many trials will it take a mouse to learn where a food source is locate without making mistakes getting there?

After the experiment, have students analyze the data collected and apply it to helping manage mouse populations when they are pests.

For additional ideas and experiments with other animals, please see the following book:
- Kneidel, S., 1999. *Classroom Critters and the Scientific Method*. Fulcrum Publishing. ISBN#: 1555911188

Background:

Mice and rats are often mistaken for one another. The house mouse is a nocturnal rodent that is commonly found in and around homes, farms, barns, open fields, and other establishments. They are small, grayish brown in color and can measure up to 7.5 inches in length, including the tail. They have pointy noses, large ears, small

feet, and whiskers. An adult house mouse can weigh up to an ounce, but most average around 1/2 to 3/4 of an ounce. They usually prefer grains and seeds, but will eat a variety of foods if they are present. They get water from the food they eat but will drink water if it is available. The average house mouse lives approximately 9-12 months. A female can produce five to ten litters in a year with each litter usually containing 5-6 offspring. Young mature 6-10 weeks after birth. This can create a large population of mice in a relatively short period of time. Calculating the reproduction rate of mice can be a wonderful opener to this activity. Refer to *Enrichment Activity 1* found at the end of this lesson for more details.

The house mouse can be very destructive. They build their nests out of shredded material such as paper, cloth, and wood chips, feathers, fur or other materials they can find. Mice have very strong teeth and can gnaw through many materials including lead and copper piping, aluminum, wood, sheetrock, and plastic during their search for food and nesting materials. Besides destroying materials and food, mice may also be ***vectors*** of disease. Because of the damage mice can cause and the diseases they may carry, it is important to prevent these pests from entering an establishment or properly controlling them if an infestation already exists. Seal openings, remove food, and choose traps that are appropriate to the pest and the situation. Using these and other Integrated Pest Management (IPM) techniques can minimize risks to both human and environmental health when managing rodent pests, such as the house mouse.

Getting Ready:

1. Decide if the experiment will be done as a class or in small groups. If done as a class, use a ***terrarium*** so all students can observe the mouse. If done in small groups (2-4 students) either a box or terrarium can be used.

2. For younger students, having additional adult supervision is strongly recommended if the experiment is going to be conducted in small groups.

Doing the Activity:

1. Cut a blank piece of paper to fit exactly in the bottom of the empty terrarium or box.

2. Using a pencil, draw a rectangle on the paper that is 2 inches (5 cm) from the outer edge at all points. Trace over the rectangle with the black marker.

3. Place the paper in the empty terrarium or box with the rectangle facing upwards. The pattern creates a "racetrack" around the outer edge within the container.

4. Write a hypothesis. Will the mouse spend most of its time against the wall (in the "racetrack") or in the center of the terrarium or box?

5. Assign the following roles to the students. If working in groups, no more than 4 per group is recommended.

- **Data Recorder:** Records the location of the mouse (next to the wall or in the center) on data sheet
- **Timer**: Lets Data Recorder and Watcher know when to collect the data (at timed intervals)
- **Watcher** *: Constantly watches the mouse and says where the mouse is located when time is called
- **Mouse Handler** *: Places the mouse in the terrarium/box and removes it after the experiment

(* These two roles can be combined with the roles of Data Recorder and Timer for smaller groups)

6. ***Safety!*** Go over the proper techniques of handling mice. Mice can bite even if they've been handled often. For skittish mice, hold the mouse by the base of the tail. This will not hurt them. Cup the other hand under the mouse's body and gently place the mouse in the empty terrarium/box. Do not pick the mouse up by the tip of the tail. This can be painful to the mouse and the tail may break. Emphasize that no harm is to come to the animal and that anyone who touches the mouse, must wash their hands thor-

oughly when finished.

7. The **Mouse Handler** places the mouse in the terrarium/box. At the same time, the **Timer** begins watching the clock.

8. *Trial 1*: For 2 minutes, the **Timer** announces ten-second intervals. Every ten seconds, the **Watcher** tells the **Data Recorder** where the mouse is located, either against the wall or in the center. The mouse is considered "against the wall" if over 1/2 of the mouse's body is between the container's side and the black rectangle line. The **Data Recorder** records where the mouse is located under "data collection" on the data sheet.

9. After 2 minutes, have the students change roles. If this will not happen quickly, remove the mouse from the terrarium/box so it does not become habituated to it, which may alter the data.

10. *Trial 2*: Continue recording data every ten seconds for 2 additional minutes duplicating the steps from trial one. After all trials are complete, students within a group should copy the data collected by the **Data Recorder** onto their own papers. Answer the remaining questions on the data sheet.

11. Using the data collected by the group, create a bar graph. Develop an appropriate title for the graph and properly label the x-axis and y-axis. Have students graph the data they collected on the computer.

12. Use the graph and the data collected to answer the following questions:

- Why do you think the mouse spends most of its time in this location?
- How can humans use this information to help control mice that are pests?
- What type of trap would you use to catch a mouse? Why? In what location and direction should the trap be placed to have the highest success rate of catching a mouse? Why should it be set it up this way? Research different types of mousetraps available on the Internet.

Enrichment Activities:

1. Calculate how many offspring one female mouse can produce in a year. On average, one female mouse can have five to ten litters in a year with each litter usually containing 5-6 offspring. Calculate total offspring for both the minimum (5) litters per year and the maximum (10) litters per year. Take the activity further by considering the offspring (use 6 offspring for easier division). If the original female had 6 offspring per litter and 1/2 of them were female, calculate the total offspring for each of these 3 females per litter.

2. Identify the ***independent*** and ***dependent*** variables, as well as the ***control variables*** for the experiment (see glossary for definitions).

3. Explore the school for evidence of mouse activity and areas where mice could enter the building. Talk with administrators and pest control operators for the school about what is being done to prevent a mouse problem or to manage the mouse population within the school.

Reading Connection

Depending on how it is used in the classroom, the following book can address PA Reading, Writing, Speaking, and Listening Standard 1.1: Learning to Read Independently and Standard 1.2: Reading Critically in All Content Areas.

- Kalman, Bobbie and Jacqueline Langille. *What is a Rodent?* Crabtree Publishing Company. 2000.

This is a book from "*The Science of Living Things*" series. Examines the basics of rodent physiology, habitat, diet, and behavior. Focuses on several common rodent species. Grades 1-6. ISBN: 0-86505 951-9

Amber Gray with the PA IPM Program at the Pennsylvania State University adapted "*To Catch a Mouse*" from Exploring Urban Integrated Pest Management "Classroom Experiments with Mice" developed by Michigan State University Pesticide Education, 2001.

To Catch A Mouse...

Name:_____ Date:_____

Question: Do mice spend most of their time against the wall or in the center of an area?

Hypothesis:_____

_____

_____

_____

_____

Data Collection: Record tally marks in the appropriate category

TRIAL 1

Next to the Wall	Center of Terrarium/Box
Total number of tally marks for "Next to the Wall": _____	Total number of tally marks for "Center of Terrarium/Box": _____

TRIAL 2

Next to the Wall	Center of Terrarium/Box
Total number of tally marks for "Next to the Wall": _____	Total number of tally marks for "Center of Terrarium/Box": _____

Conclusion:_____

_____

_____

_____

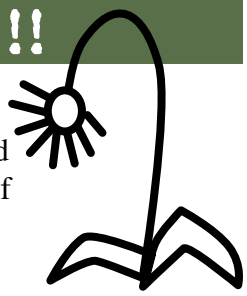
_____

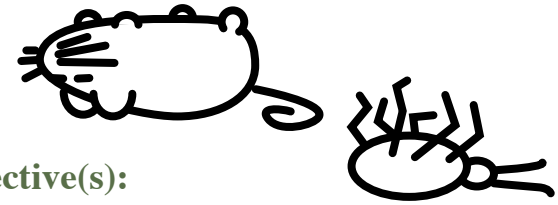
_____

Was your hypothesis accepted or rejected based on the data you collected? Accepted or Rejected

Caution! Warning!! Danger!!!

What is a pesticide? What is it used for? Who should use a pesticide? Many individuals use some form of pesticide to manage a variety of pests that may be found in and around the home. However, these and other chemicals are often times stored within the reach of children. This activity is designed to help students keep themselves safe from pesticide exposure.





Suggested Level(s):
Grades 1-3
Adaptable for older students

Subject(s):
Environment & Ecology, Health, Safety, & Physical Education

Standards:
Environment & Ecology
4.5: Integrated Pest Management (IPM)

Health, Safety, and Physical Education
10.2 Healthful Living

Skills:
Observing, Critical thinking, Discussing, Presenting, Creating, Applying

Technology Connection:
Digital camera, Software and printer to print photos from camera

Materials *(per class or group)*:
- Empty containers
- Pesticide labels
- Common household items (see "Getting Ready" for specifics)
- Plastic pest species (ant, roach, mouse)
- Children's plastic toys
- "Mr. Yuk" stickers (see last page of lesson)

Time Consideration:
- Preparation: Up to several hours
- Activity: 45-60 minutes

Objective(s):

Students will...
- define the term pesticide and identify common household pests that chemicals may be used to manage
- recognize specific information required to be on a pesticide label, including ***signal words***
- discuss actions that can be taken to promote pesticide safety with peers and adults and apply it to their home environment

Assessment Opportunities:

Have students create a "Pesticide Safety" bulletin board, poster, or brochure to display in the school. Include simple things individuals can do to keep pests from coming into the home such as removing food and water sources. Bulletin board, poster, or brochure should address proper pesticide safety behavior.

Background:

Pests enter areas where humans don't want them because the pests are searching for food, water, and shelter. When employing an Integrated Pest Management (IPM) approach to managing pests, there may be situations that warrant using a pesticide in conjunction with other tactics.

A pesticide is a chemical used to kill a pest organism. There are many classes of pesticides. Several common ones are listed below:
- **Insecticide** – kills insects
- **Herbicide** – kills weeds
- **Rodenticide** – kills rodents
- **Fungicide** – kills fungi
- **Bactericide** – kills bacteria

Notice that all classes of pesticides end with the

same suffix. The suffix "-cide" means "to kill."

Not reading the pesticide label and improper use of a pesticide can result in illness or poisoning. Reading and understanding a pesticide label can be tricky, but every pesticide label must contain specific information. Every container has a signal word printed on it, which indicates the potential hazard level to humans. Beginning with the least harmful and increasing to the most harmful "**Caution**," "**Warning**," "**Danger**," and "**Danger-Poison**" are the signal words used on chemical labels. Children need to recognize these signal words and learn not to touch, eat, or drink from these containers. It is important for adults to know what information can be found on labels to help answer questions students may have. For more information on pesticide labels and the information found on them, visit **http://www.epa.gov/pesticides/label/**.

Pesticides should be stored in a locked cabinet when not in use. They should not be stored under a sink, in a low cabinet or on a shelf where children and pets can access them. Never pour or place pesticides into a different container for storage. Do not smell, drink, or eat a pesticide or anything that was placed into a pesticide container. Pesticides are very dangerous and can make a person sick if they are inhaled, ingested, or get in the eyes or on the skin. Pesticide residue can remain on an item even after it is wiped off.

Getting Ready:

This activity can be done several ways, depending on the situation and supplies available. This version sets up "mock" rooms found in and around a house. Each room is considered a station. Pictures or a felt board can be used in place of the stations.

1. Purchase clean, empty spray bottles and containers in various sizes. Photocopy actual pesticide lables, download labels created by PA IPM for this activity from **www.paipm.org**, or develop your own pesticide labels. Attach the labels to the empty containers.

2. Decide which rooms in and around the home you want to simulate. Possible suggestions include:
   - The kitchen and under the kitchen sink
   - Hall closet
   - The bathroom and under the bathroom sink
   - The garage
   - Laundry room
   - Basement

3. Decide where each station will be set up. Check to see if there are more appropriate places available around the school, such as the cafeteria or janitorial closets. Take pictures with a digital camera of room(s) to show students if other options aren't available.

4. Set up the stations with the pesticide containers and other items commonly found in those rooms. Also include common pest species. Examples for the kitchen and garage appear below:

For the kitchen place the following items in, around or under the sink:
Ant/roach killer, ant bait stations, anti-bacterial cleaners, bleach, crumbs, pieces of food, water, dust rags, paper towels, cooking utensils, trash bags, trash can, cleaning sponges, plastic ants, roaches, etc.

For the garage place the following items in, on and around shelving:
Lawn care items, weed pesticides, insect repellant, flea/tick shampoo for pets, children's toys, buckets, gardening equipment, garbage can, dog/cat food, recycling bin, plastic mouse/rat, etc.

5. As a class, discuss the following questions and points before visiting the stations.
   - What common pests are found in homes?
   - What are pests looking for in homes?
   - Why/how to manage the pest? Discuss IPM.
   - What is a pesticide? Identify signal words.
   - Proper safety behaviors around pesticides.
   - Explain "***Mr. Yuk***"* - poison education symbol in US.

Caution! Warning!! Danger!!!

Doing the Activity:

1. In small groups or as a class, have students visit each station making notes about what pests are present, what pesticides they see, the signal words on the containers, and safety concerns about where the pesticides are located.

2. Come back as a class and discuss what students found and what they suggest should happen in each room to keep themselves and others safe from pesticides. What preventative measures can be taken to keep pests out – think IPM. Where would they put Mr. Yuk stickers? As a class create a pesticide safety check-off list of items to look for as they go through rooms in their own home and list simple ideas of what they can do to make their home safer.

3. Send a copy of the check-off list and a sheet of Mr. Yuk stickers home with each student. With an adult at home, have students go through the check-off sheet and place Mr. Yuk stickers on dangerous chemicals. Students should report back to the class about what they found in their home.

Enrichment Activities:

1. Invite a representative from your county cooperative extension office or the local poison control center to talk with the class about pesticide safety. Invite parents and guardians to attend as well.

2. Take pictures of rooms before and after Mr. Yuk stickers are placed on dangerous containers. Use the pictures on a bulletin board or poster display.

For Older Students:

1. Tell students they are a pesticide safety inspector. They are going to be inspecting a house looking for pesticide safety issues. After their inspection they will be writing a report to the homeowners about what they found and their recommendations for change.

2. Visit the Penn State Pesticide Education Program web site at http://www.pested.psu.edu/. Look under "Youth and K-12 Educators" for related activities and games. Students can solve puzzles and chase D.B. Pest throughout a house while answering questions on pesticide safety and Integrated Pest Management.

For Mr. Yuk information and stickers contact:
Pittsburgh Poison Center
Children's Hospital of Pittsburgh
3705 Fifth Ave.
Pittsburgh, PA 15213-2583
412-692-5325
http://www.chp.edu/mryuk/05a_mryuk.php

Amber Gray with the PA IPM Program and the Pennsylvania State University developed *"Caution! Warning!! Danger!!!"*

Glossary

Action Threshold – The size of a pest population at which something must be done to manage it before it becomes too large. Factors to consider when determining how many pests are too many: Health hazards, economic damage, cosmetic damage, and personal tolerances.

Adaptation – Modification of an organism or its parts that makes it more fit for existence under the conditions of its environment.

Arthropod – The phylum that contains organisms with jointed legs and segmented bodies. Includes insects, spiders, crustaceans, etc.

Biome –A major regional or global biological community, such as grassland, forest, or tundra, characterized chiefly by the dominant forms of plant life and the prevailing climate.

Ecosystem – A system formed by the interaction of a community of organisms with their environment.

Host – Any organism on or in which another organism lives.

Hypothesis – A proposed explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation.

Insect – Any of a large class of small, usually winged, invertebrates (animals without backbones), such as beetles, flies, wasps, etc., having three body parts and three pairs of legs.

Integrated Pest Management (IPM) - A scientifically based decision-making process, which incorporates a variety of technological and management tactics to achieve long-term, environmentally sound pest suppression. Common-sense pest control focused on using multiple tactics and stressing prevention and other least toxic methods.

Larval Stage – The second developmental stage for an insect that has a four-stage life cycle: egg, larva, pupa, adult. A larva is the immature, wingless, feeding stage of an insect that undergoes complete metamorphosis to transition to the adult stage.

Mr. Yuk - The most commonly used and recognized poison education symbol in the United States. The Mr. Yuk face is used on product labels of hazardous materials to indicate they are poisonous.

Niche - The unique position occupied by a particular species, conceived both in terms of the actual physical area that it inhabits and the function that it performs within the community, where a living thing is found and what it does there. The term “niche” can include habitat, food sources, activities and interactions with other living things. Due to competition, two species are not expected to share the same exact niche for long.

Pathogen – Something that causes disease or death in an organism.

Parasite – An organism that lives on or in another organism (the host), causing harm to it.

Pest – An organism that is troublesome or destructive to people or their property. Pests can include some insects, fungi, weeds, animals, bacteria, etc.

Pesticide – A chemical product designed to kill pest species.

Predator – An organism that kills and eats other organisms.

Prey – An animal that another animal eats.

Pupal Stage - The third developmental stage for an insect that has a four-stage life cycle:

Glossary

egg, larva, pupa, adult. The pupa does not feed and is usually immobile while it transforms from the larva to the adult stage.

Signal Words – A word printed on a pesticide label to indicate the potential hazard level to humans: Caution (least hazardous), Warning, Danger, or Danger-Poison (most hazardous).

Taxonomy – The science dealing with the description, identification, naming, and classification of organisms into an ordered system that indicates natural relationships.

Terrarium – a transparent enclosure for keeping or raising plants or small animals indoors.

Toxic – A word that means "poisonous in certain amounts."

Toxicity – The degree to which a substance is toxic.

Variables – Factors present in a scientific experiment. Types of variables:

- Independent Variable: the factor that is manipulated or changed in an experiment
- Dependent Variable: the factor that responds to or is determined by the independent variable in an experiment
- Control Variables: all factors that remain unchanged in an experiment.

Vector – An organism that transmits a pathogen or disease-producing organism.

Notes and Additional Terms

Environment & Ecology Academic Standard 4.5: Integrated Pest Management (IPM)

What is integrated pest management (IPM)? Why is it important enough to be included in the Pennsylvania academic standards? At one time or another, pests have bothered us all because pests occur in every environment. It may be the unwanted ants in the kitchen, flies buzzing in the house, or rabbits eating the vegetables out of the garden that drives humans to find ways to manage the problem. But do we choose the most effective and environmentally safe ways to solve the problem?

IPM is a scientific approach to pest management that emphasizes preventing pest problems before they get out of hand. IPM stresses the importance of proper pest identification and the use of multiple tactics when managing a pest problem. The use of non-chemical methods such as proper maintenance and removing access to food and water are the first lines of defense. While chemical pesticides are sometimes used when dealing with pest species, IPM focuses on choosing effective, less toxic, safer products. Some tactics used to control pests can have detrimental side effects. For example, pesticide misuse can pollute the environment as the pesticides enter the air, soil, and water sources. Several pesticides that have been banned for decades can still be found in water samples taken today. Pesticides can also impact human health as they enter our bodies or get on our skin. IPM strikes a balance by reducing pest populations to acceptable levels as well as protecting the environment and human health. As society, science, and technology change, ideas, practices, and the information available does as well.

The Pennsylvania Department of Education is dedicated to educating students about science, technology, and the environment and ecology. In the fall of 2001, the Pennsylvania State Board of Education and the Regulatory Review Commission voted on newly proposed academic standards. The decision was unanimous and the Science and Technology and the Environment and Ecology Academic Standards were adopted. Integrated pest management is the fifth standard under the subject of Environment and Ecology.

The academic standards identify for educators what students need know at certain levels of their education. Teachers are required to teach subject matter put forth in the academic standards. In Pennsylvania, students are then tested on the standards using the Pennsylvania System of School Assessment (PSSA). Scores are used to identify problem areas for particular students and improve curriculum and instruction. Because IPM is an academic standard, K-12 teachers are required to cover this subject area, even if they don't have background knowledge on the subject matter. IPM questions can and will be seen on future PSSA tests. The Pennsylvania Integrated Pest Management Program (PA IPM) at the Pennsylvania State University and the Pennsylvania Department of Agriculture are dedicated to assisting educators in gaining the knowledge and skills necessary to effectively teach IPM in the classroom and to help students become good decision makers. The IPM Jump Start lessons are designed to help teachers and elementary students take the first leap into learning about IPM.

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This publication is available in alternative media on request.