Conservation Conversations

Integrated Pest Management

COURSE

Agriscience Foundations Unit: Entomology Total Time: 65 minutes Materials: PowerPoint, insect collection jars, nets, laptop, examples of control methods

AFNR* STANDARDS

5.0 Investigate and utilize basic scientific skills and principles in plant science. The student will be able to:

• 5.07 Investigate the impacts of various pests and propose solutions for their control.

ESSENTIAL QUESTION

How do we prevent and manage for insect pests?

OBJECTIVES

1. Define insects as harmful or beneficial.

- 2. Discuss integrated pest management (IPM).
- 3. Describe the advantages and disadvantages of different control types.

ACTIVATING STRATEGY

(~5 min) Review - Ask students, "What is entomology?"

• Explain - Take responses from 1-2 students. Then, explain that entomology is the study of insects.

Review - Ask students, "What features make an insect identifiable?"

- Explain Take responses from 3-4 students. Clarify that insects have three body segments (head, thorax, abdomen), six legs, and two antennae.
 - Alternative: If no students recognize the term, break it down. Write the word entomology on the board, or when teaching in nature, with chalk on the ground.
 - Ask students, "Do you know any other words that end with -ology?" Take 2-3 responses and write them on the board. Examples include biology, geology, hydrology, etc.
 - Ask students, "Now that we have examples of multiple words that end in -ology, what does the suffix -ology mean?" Take 1-2 responses. Then, explain "-ology means the study of. All of the words we listed mean the study of something."
 - Explain "Now, we will look at the prefixes to determine the word's meaning." Apply this to the students' examples, breaking down the prefix/suffix to identify meaning. For example, biology = bio- (life) and -ology (study of); therefore, biology = study of life. Or hydrology = hydro- (water) and -ology (study of); therefore, hydrology = study of water.

*AFNR stands for Agriculture, Food & Natural Resources. The lesson plan content aligns with Florida AFNR pathway standards. "The prefix entomo- means insect. Can anyone explain what the word entomology means now?"

Activate/Question - To start today's activity, ask students, "Are all insects pests?"

• Take 4-5 responses. Probe as needed. To prompt more discussion, ask students, "What insects do you like or dislike?" Then, explain that all insects are not pests. Ladybugs, butterflies, bees, and beetles are all examples of beneficial insects. A pest means the insect harms the environment, livestock, crops, or human health. Some examples of pests are aphids, fleas, and cockroaches.

Context - When we do have pests, we need to properly manage for them, using integrated pest management.

LEARNIG APPROACH 1

Demonstrate active collecting techniques and classification - (~15 min)

- Before going outside, discuss the basics of insect collecting (where to find them, how to use the nets, etc.) and the types of damage to look for.
 - Insect collecting 101
 - https://entnemdept.ufl.edu/bug_club/ent-events/collecting101.shtml
 - Sweeping technique
 - <u>http://extreme-macro.co.uk/sweep-net/</u>
 - Damage
 - Chewed leaves, flowers, foliage, etc.
 - Holes in stems, branches, or bark
 - Dieback of plant parts
 - Discoloration of plant parts
 - Insect by-products (frass, silk, mold, foam, etc.)
- Collect insects around the site using nets and jars. Then, return to the classroom to discuss and make observations.
 - Identify each type of insect caught
 - Review what characteristics to observe to make classifications
 - Three body segments (head, thorax, abdomen), six legs, and two antennae.
 - Spiders are not insects!
 - Two body segments and eight legs
 - <u>https://entnemdept.ufl.edu/bug_club/100_insects/index.shtml</u>
 - This resource has 100 common insects found in Florida. It also has a bug identification key to help identify what Order your insect is in if it is not included on the list. Thirteen common orders of insects are displayed on the home screen. Students can select the type of insect they have collected, and a more specific list of potential insects will be displayed for the student to choose from.
 - Example: The student caught a wasp but does not know what kind of wasp. They would click "Order Hymenoptera: Ants, Bees, and Wasps." Then, they could use the list of specific species with pictures to determine it was a yellowjacket wasp.

https://www.insectidentification.org/insects-by-state.php?thisState=Florida_

- This resource has over 1,000 common insects found in Florida but can be more challenging to navigate. I recommend scrolling down to "quick lists" and selecting from the list of six common insect types to find a specific species (beetles; ants, bees, wasps; butterflies and moths; grasshoppers and crickets; dragonflies; true bugs). Then, results can be refined by color. This site may be useful to find more species if they are not included in the first resources list.
- Potential insects to catch/display include Ladybugs, butterflies, praying mantis, aphids, caterpillars, ants, bees, beetles, wasps, and grasshoppers.
- Discuss whether each insect is beneficial or harmful (pest).
 - What makes an insect beneficial?
 - What makes an insect harmful?
- Alternative
 - Display various insects for students to make observations
 - Examples can be physical (preferred) or displayed visually on the front board
 - Display various examples of damage/impacts of pests
 - Have students guess what type of pest caused the harm
 - Discuss what type(s) of control methods they think could be used to eliminate the issue
 - Ex: Leaf miners: larvae tunnel into the leaves to feed, but cause irreparable damage
 - Ex: Tomato hornworms: caterpillar that feed on tomato plant leaves and can completely defoliate the plant
 - <u>https://gardeningsolutions.ifas.ufl.edu/care/pests-and-diseases/pests/</u>

LEARNING APPROACH 2

Lecture & Discussion - (~40 min)

- (~15 min) Present definition of integrated pest management and its 5 components
 - "Now that we have collected and identified several insects, we are going to dig a little deeper into the proper steps to take when you realize you have an insect pest problem."
 - Integrated Pest Management (IPM): sustainable and ecosystem friendly approach to managing pests by combining biological, cultural, physical, and chemical practices.
 - Components:
 - Pest Prevention
 - Pest Monitoring
 - Decision-making
 - Treatment
 - Evaluation

- Components (expanded)
 - Pest Prevention
 - Practice proper plant care healthy plants have less problems!
 - Do not leave out food this attracts pests indoors.
 - Seal gaps in your home so pests cannot get inside.
 - Sanitation
 - Discussion
 - What are some practices of pest prevention you have done before?
 - What does proper plant care mean?
 - Pest monitoring
 - Correct identification is critical if you cannot correctly identify your pest, you cannot apply the correct control methods.
 - Routine inspection without this, how will you know if there is a pest problem?
 - Assessing pest numbers and damage keep an inventory.
 - Discussion
 - How would you record pest numbers and damage?
 - What do you do if you do not know what kind of insect you are dealing with?
 - What types of impacts can pests have that we need to monitor?
 - Decision-making
 - Action threshold: environmental, economic, health
 - Identify the problem and determine when management is necessary.
 - Understand the life cycle of pest/disease.
 - Discussion
 - Does everyone have the same action threshold?
 - What criteria would you use to determine when the tolerable level reaches a tipping point?
 - Why would understanding the life cycle of the pest be important?
 - Treatment
 - Consider the scope and intensity of the IPM.
 - Chemical controls should only be implemented when absolutely necessary and applied to minimize negative effects.
 - Discussion
 - How do you define scope and intensity?
 - Do you think it's better to use one treatment at a time, or try a combination?
 - Do we need to create a treatment plan for any of the insects we collected?
 - Evaluation
 - After action is taken, assess the effectiveness of the treatment.
 - Discussion
 - What types of questions would you consider when evaluating an IPM strategy?
 - Ex: Was it successful? What needs to be changed?

- (~25 min) Discuss types of control methods
 - Present each type of control method one at a time (biological, cultural, mechanical, and chemical). Provide students with a definition and example of the method.
 - Then, give students 1-2 minutes per method to brainstorm the advantages and disadvantages of the control type. Allow 2-3 student responses for the advantages and disadvantages of each method, then review.
 - Biological Control
 - Use of natural enemies to control pests and their damage in a targeted way.
 - Can be predators, parasites, pathogens, or competitors such as invertebrates, nematodes, weeds, etc.
 - Ex: releasing ladybugs in a garden with an aphid infestation
 - Advantages: targets a specific pest, does not produce harmful byproducts
 - Disadvantages: expensive, takes a long time to become effective
 - Cultural Control
 - Practices that reduce pest establishment, reproduction, and survival
 - Ex: Removing standing water containers to prevent mosquito larva growth
 - Ex: hanging irrigation practices to reduce excess water, root disease, and weeds, which can attract pests
 - Advantages: easy to implement, low cost
 - Disadvantages: typically, only a preventative method, requires long-term planning/precise timing
 - Mechanical Control
 - Creating barriers, using traps, or physically removing pests
 Ex: rodent traps, mulching, picking pests off of plants
 - Advantages: low cost, non-toxic
 - Disadvantages: time consuming, labor intensive
 - Chemical Control
 - Use of pesticides or chemical compounds
 - Advantages: low cost, fast acting, easy to apply
 - Disadvantages: contamination of groundwater, non-target species harmed
 - Alternative: Create small groups of 4 students. Assign each member of the group a different control method. Give students 10 minutes to independently research their assigned control method's definition, examples, and advantages/disadvantages. With the remaining 15 minutes, each student will present their findings to the other three group members. Prompt students after roughly four minutes to let the next group member present.

RECOMMENDATIONS

- For extending learning opportunities within the lesson
 - Display multiple examples of each type of control method. Have students classify each example as a type of control method. Facilitate discussion about why/how the students categorized each example.
 - Examples can be physical (preferred) or displayed visually on the front board
 - Ex: Raid, rodent traps, cockroach traps, predatory insects, etc.

• Reflection -(5 min)

- Reflective discussion: Why is IPM important?
 - Eliminates pests in a safer, eco-friendly way. Reduces the environment and your exposure to potentially harmful chemicals.
- Alternative: Do any of the insects we collected need an IPM strategy to control their populations? Why, or why not? What strategies would be the best to use?

RECOMMENDATIONS

- For extending strategies for learning after the lesson
 - Pest Presentation
 - Have students select a pest they think is interesting or one they have encountered. Instruct them to research and answer the following:
 - Where have they encountered this pest before?
 - Who is typically most impacted by this pest?
 - What type of damage or impact does this pest cause?
 - Are there any pest prevention strategies that could be employed to reduce the chance of this pest being a problem?
 - What are examples of each control type that could combat this pest?
 - Are there examples of each control type that can target the pest they selected?
 - Students can create a poster or slideshow and present a 5-minute (max) presentation to the class about the insect pest they selected.
 - Pinning
 - Have students collect 1-2 insect specimens to bring to class
 - Students can bring insects in through jars, ziploc bags, etc.
 - Provide a demonstration on how to pin an insect properly
 - Allow students to pin their insects
 - <u>https://extension.entm.purdue.edu/401Book/default.php</u>
 - Discuss the importance of pinning
 - Allows for proper identification
 - Teaching tool
 - Case Study
 - Provide students with different scenarios and have them generate an IPM strategy that proposes a solution for the client