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Entomology

Core Curriculum Content Standards: 3.3.A, 3.4.A, 5.1.A, 5.5.A&B, 5.10.A&B, 6.6.E

Session Description

This activity focuses on the fascinating, yet often overlooked, world of insects. Students will capture, identify, and observe insects from a variety of habitats using nets, traps, and lures. The discussion will include insect morphology and physiology, life cycles, and the impacts of insects on humans, both positive and negative.

Objectives

1. Students will list the characteristics of insects.
2. Students will develop techniques for finding and capturing insects.
3. Students will name the basic parts of an insect and describe how they function to help the insect move, eat, breathe, defend itself, and sense its environment.
4. Students will generate a list of the negative and positive impacts of insects on the lives of humans.
5. Students will compare the number of vertebrates in the animal kingdom to the number of invertebrates, arthropods, insects, and beetles, respectively.

Materials

7 sweep nets 14 bug boxes 7 wide-mouthed jars w/ lids
7 magnifying glasses 4 laminated field guides 4 Golden Guides
Animal Kingdom Pie Chart laminated insect fact sheet
Laminated Insect Anatomy Diagram plastic arthropods arthropod pictures
pit traps white sheet bait for traps Borneo story card

Procedure

1. If desired, prepare a few pit traps in the wildlife habitat area and bait them with slices of apple or bacon a few hours to one day before the session. Also, paint a few trees along the edge of the woods with a molasses/sugar mixture. You may wish to have the students paint one or two trees with the mixture for successive classes.

2. Begin the session by informing students that they will have the opportunity to capture an animal that has five eyes, spits acid, has ears on its sides, breathes through holes on it sides, and propels itself with spring-loaded muscles. What animal is being described?

3. Have each student choose a plastic arthropod or laminated picture of an arthropod. Ask the students to sort them into two piles based on whether or not they fit into the category of insects. When they have finished, list on the board the characteristics that make an animal an insect: three body parts and six legs. Insects, like all other arthropods, also have a hard exoskeleton made of chitin.

4. Draw the head, thorax, and abdomen of an insect on the board and have students share their knowledge of insects as you add to the drawing. Use the laminated insect fact sheet as a guide. With older students, introduce the eight major orders of insects and have them practice by sorting the plastic insects into orders.

5. Ask students if they can describe the typical life cycle of an insect. Most likely they will describe complete metamorphosis, which involves four life stages: egg, larva, pupa, adult. In incomplete metamorphosis insect eggs hatch into nymphs which differ from the adults in size and proportion and by the fact that they lack wings. Insect nymphs transform into adults by molting several times. Grasshoppers, bugs, and dragonflies are examples of insects that undergo incomplete, or gradual metamorphosis.

6. Inform students of where and how you will be capturing insects. It is always safest to roll rocks and logs that you will be looking under towards your body to act as a protective barrier. It is also imperative to place rocks and logs back in their original positions after looking under them or important microhabitats will be destroyed. Check the pit traps and lures in the wildlife habitat and use the sweep nets in the long grasses by the edge of the lake or at the leach fields at the wastewater treatment plant. Search for insects in the trees by having students hold a sheet beneath a leafy branch. Have another student shake the branch to knock insects onto the sheet.

7. Bring a few insects back to the classroom to observe using magnifying glasses or the stereomicroscope. Younger students can observe how the insect moves, breathes, senses, eats, and cleans itself. Older students may wish to identify the species or order to which their insect belongs using the field guides.

8. Release all insects.

9. Have students brainstorm to create a list of both the harmful and beneficial impacts of insects on humans.

Summary

Show students the chart indicating the relative numbers of vertebrates vs. invertebrates, arthropods, insects, and beetles. Does the information in this chart change their perspective on their own impacts on the planet? How?

You may wish to discuss insect control and its effects. Thirty percent of our harvest is eaten by insect pests. This is close to the percentage taken before we began using pesticides. As stronger and stronger pesticides are introduced, the weaker insects are weeded out and the resistant ones reproduce and multiply. Pesticides also affect our water and other animal populations, including beneficial insects, birds, amphibians, reptiles and mammals. Alternatives to pesticide use include releasing natural predators such as lady bird beetles, building bat and bird houses near gardens, introducing bacteria or insect viruses to kill a targeted pest, planting insect-repellant plants around more vulnerable ones, releasing sterile insects to mate with fertile ones, using pheromone traps to attract and trap harmful insects looking for mates, and studying the life cycle of the pest to avoid planting or harvesting when it is most abundant.

Finally, read the story The Day They Parachuted Cats Over Borneo. What important point about ecology is illustrated in this story?

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The Day They Parachuted Cats Over Borneo

The following true story is paraphrased from the above novel
by Charlotte Pomerantz, published in 1977.

Borneo is a huge island bigger than Texas in Southeast Asia. Its dense tropical rainforests harbor a diversity of insects, including the mosquito which carries malaria. The people of Borneo used to drain the mosquitos' swampy breeding grounds and spray a thin layer of oil on stagnant water during the breeding season to discourage the mosquitos. This kept the malaria rate down, but many people still got sick.

During W.W. II, Dr. Paul Mueller, a Swiss scientist, discovered DDT, or dichlorodiphenyl-trichloroethane, a chemical compound which kills insects. This is the stuff that was sprayed on Borneo, and it did indeed kill off hordes of mosquitos.

At first, the problem seemed to be solved. Unfortunately, DDT, like other pesticides, doesn't just affect one thing. This is the way things unfolded in Borneo:

Cockroaches weren't killed, but the DDT was stored in their bodies. Likewise with the caterpillars which lived in the people's thatched roofs, eating the beams and thatching.

Geckos are lizards which the Borneans welcome in their homes because they eat cockroaches and caterpillars. However, after the DDT was sprayed, the geckos stored more poison with each insect they ate. The DDT attacked their nervous systems and made them very sluggish. Too sluggish to catch the caterpillars, which continued to eat the roofs. Roofs caved in all over the island.

So sluggish were the geckos that they were easily caught and eaten by cats. Now think of how the DDT is multiplied at each level of the food chain because animals' bodies can't get rid of it. Each insect stored it. Each lizard stored the poison from many insects. What happened to the cats after eating a few lizards? They all died.

The Borneans had cats in the first place because they ate the rats. The rats, eating low on the food chain, were not affected much by the poison. Suddenly they had no predators and their population boomed. They were all over the place, getting into people's homes and food supplies. People began fearing that the rats and their fleas would spread the plague.

Meanwhile, DDT washed into the soil and streams and accumulated in fish and other aquatic animals, killing many of them.

So the people asked for help. They wanted cats to control the rat problem, but delivering cats on a tropical island without a good road system presented problems. What did they do? They flew planes over and parachuted them in.

There was a lot of trouble and expense because people thought they could affect one part of the environment without disrupting the rest of it. Although DDT is now illegal in the U.S. and many other countries, U.S. companies still produce over 39 million pounds of it a year and ship it to third-world nations. We even get some of it sent back to us in our imported produce. Probably, every person in the world has some DDT in their tissues. Even penguins tested in Antarctica do. As the famous conservationist, John Muir, once said, ìf you tug at one thing in nature, you find that it is hitched to the rest of the universe.

Field Activities

Sweep the nets: Many small insects can be captured by sweeping the nets through tall grasses. Insects may be spotted first then pursued. Be careful of stinging insects!

Investigate pit traps. Several pit-fall traps have been located in the wildlife management area. If the traps are baited prior to the session you should see a lot of action.

Lure insects by painting trees with a molasses/sugar mixture. This works best for attracting moths at night but many diurnal (daytime) insects will also be attracted. For best results paint the day before class and let the students try their hand at painting during the class. Trees at the edge of the forest are best. Other mixtures are also affective such as fermented fruit mixed with sugar. Believe it or not, one of the best baits for luring down high-flying butterflies is a dead snake hung in the open.

Decoy the butterflies! Tiger swallowtails and other kinds can be attracted to paper cut-outs painted natural colors and hung on a thread to move in the breeze. Sometimes butterflies will circle them for minutes at a time. If there is time before the students come, they should make their own decoys.

Look closely in flowers for pollinators and their predators.

Smell the insects! Red ants are great. They will spray formic acid. One good whiff of an ant held between the fingers will let the students know why predators avoid them. Combined with a bite, the acid really stings. Some skunks of the arthropod world include stinkbugs, some millipedes, and the beautiful, gold-eyed lacewings.

Experiment: see what ants do when their trails are interrupted by a strong smell, such as onion. Try feeding ants with sugar of a dead insect. Try feeding insects to a spider; there are a lot of spider webs on Rainbow Bridge.

Shake the tree limbs over a sheet held out by several students. Many seldom-seen insects will fall out and make themselves visible.

Rattle: listen for the buzzes, rattles, and chips of the grasshoppers, crickets, cicadas, and others. Try to track them to their sources.

& Roll over rocks and logs to find beetles and their larvae as well as insect relatives such as millipedes, centipedes, and isopods. Make sure all rocks and logs are returned exactly to the position they were in, or an entire micro-habitat will be destroyed.

Look for signs of insects such as galls and nests. Many insect galls may be found on oak trees. Look for round swellings on leaves, leaf stems, and buds. On Witch Hazel, look for the spiny witch hazel gall on the buds as well as one which looks like little witch hats—the witch hazel cone gall—on the leaves. The nests of paper wasps can be found under the eaves of many buildings at SOC. The tubes of mud dauber wasps can usually be seen on the ceiling of the carriage house.