WORM WORLDS

BACKGROUND

Earthworms are everywhere…or are they? Despite their small size and inconspicuous colors, earthworms in large numbers can be a major force below ground. Worms are decomposers – organisms that break down dead and decaying materials. When worms eat and digest organic matter such as leaves and grass, they leave behind castings that are a fertilizer for the soil. When tunneling, they increase the amount of air and water that gets into the soil. They also "till" the soil, bringing down organic matter from the top and mixing it with the soil below. Scientists estimate that a healthy worm population of 50-200 worms per square meter of ground can "move" nearly 30 pounds of soil each year!

Worms are invertebrates – animals without a backbone. Worms do not have lungs; they breathe through their skin, where the oxygen goes right into their bloodstream. Their skin must stay wet in order for the oxygen to pass through; the slimy layer of mucus on their skin helps them stay moist. Earthworms are hermaphrodites, having both male and female organs in every individual. The band near the front of the body of an adult worm is called the ***clitellum***, which contains the reproductive organs. Baby worms are whitish-colored and only .5-1 inch long. They are on their own as soon as they are born. Within about six weeks they develop a clitellum, which distinguishes them as an adult, and are then able to reproduce.

What environmental factors make for good earthworm habitat? In this activity, teams will investigate how habitat and ***environmental factors*** influence the presence or absence of worms, and will count and compare the worms they find in two study sites over the course of two FUN sessions. Students will note how many ***adults*** and ***juveniles*** are present at each site, as well as observe environmental factors that may influence their results.

SEATTLE AUDUBON

MATERIALS

Each Group Guide will have a kit containing:

1 guide card
7 pencils
7 hand lenses
3 sets of site markers (chopsticks & string)
3 shallow plastic trays
3 film canisters of dry mustard
3 clean 1-gallon milk jugs with lids, filled with clean cool water
1 anatomical worm diagram

Key Objectives

- Earthworms require certain environmental factors in their habitat in order to survive.
- Earthworms are important to have in a habitat; they are decomposers and help return nutrients back to the soil.
- Students will hypothesize about how an environmental factor impacts the abundance of worms.

SITE This investigation works best in the fall and spring. Avoid frozen or very dry conditions.

TIP Lead students through the study protocol carefully and step-by-step as a group; demonstrate how to set up a quadrat and how to mix the mustard slurry. Following directions and patience are essential for success with this activity.

VOCABULARY Throughout the activity be sure to use and reinforce the vocabulary words:

- ***environmental factor*** – conditions that have an effect on a habitat, e.g. the amount of moisture in the soil, full-sun vs. shade, presence of vegetation, etc.
- ***clitellum*** – the band around an earthworm containing its reproductive organs
- ***juvenile*** – immature; not able to reproduce
- ***adult*** – mature; able to reproduce
- ***Oligochaetologist*** - scientist who studies terrestrial and aquatic annelids (worms)

Week 1: INTRODUCTION by TEAM LEADER

The Team Leader will introduce the lesson to the entire class before dividing the students into their small field groups.

Introduce the activity to students (5 minutes)

- Why are earthworms important?
- What makes for a good earthworm habitat?
- This week and next we are going outside to discover the habitat and environmental factors that can be used to predict a healthy earthworm environment.

★ *Remind the students that, just like during Litter Critters, all worms and critters are to be handled with care. All specimens will be returned to their habitat alive, uninjured, and minimally stressed.*

Week 1, OUTDOOR ACTIVITY by VOLUNTEER GROUP GUIDE

The Group Guide will complete the activity with their small field group as described below.

TELL ME (5 minutes)

Gather the students into a circle and point out the study site boundaries

While not looking for any specific answers, facilitate the discussion by asking questions like:

- Where have you seen lots of earthworms? What was that area like?
- What makes for a good earthworm habitat?
- Think about your schoolyard. Are there some places where you would expect to find more worms than in other places? Why?
- Did you find worms during last week's Litter Critters activity? What was that habitat like?

State the challenge This week and next we are going to study how environmental factors and habitat can affect worm populations.

ACTION (25 minutes)

1. Reiterate the boundaries of your study site.

2. Introduce the activity.

Have the students look around the area and imagine what it is like below-ground in different places. Explain the environmental factors they will observe: ground cover, soil, and weather conditions.

- Do you think we will find worms in all of these habitats?
- How will we know if we have found a good worm habitat?
- If we find zero worms in a site, what does that tell us? (Finding no worms can disappoint the students. Help them understand that "zero worms" is an important scientific result.)

3. Divide the group into pairs or trios. In order to learn about healthy earthworm habitat, we need to study a variety of habitats. Have each team predict where they will find worms and choose where to set up their sample sites.

- Have them record the habitat and environmental factors present at their site, and record their predictions in their student folders.
- When they are done recording, regroup the students and have them explain how their site is different from the others. (Make sure the groups are spread out, but within the boundary area.)

4. Demonstrate the activity. Demonstrate one step at a time, allowing the students to do each step after your demonstration. Distribute the appropriate materials to each team after each demonstration of that particular step. Use one team's sample site to demonstrate how to set-up and use the materials.

a. Show how to set up a study site "quadrat" using the string and chopsticks. Put one chopstick into the loops that are on each end of the string. With the narrow end of the chopstick down, push it straight into the ground. With your partner, create three other corners with the string to form a square. Push the three remaining chopsticks straight into the ground. Send students back to their study site to do this step. Regroup at demonstration sample site when complete.

b. If necessary, gently remove long grass and other visual obstructions from sampling area so students are able to see the worms come to the surface**.**

c. Each group gets one jug of water and one shallow plastic tray.

d. Each team pours fresh water from their jug into their tray (just enough to cover the bottom) to use for rinsing the worms (a.k.a. the worm spa). Prop up one end of the tray to create a dry area so that worms do not drown. Send teams to do this step and regroup when finished at demonstration sample site. No mustard should ever go in the tray of fresh water. If it is sunny, students should create shade over the plastic tray to protect the worms.

Keep in mind…

- Scientific process is important in this activity.
- Explain that "zero" results are good data.
- Count both adult and juvenile worms.

e. Demonstrate how to make the slurry and pour the slurry onto the sample site. Pour one canister of mustard into a water jug. Put the lid on the jug and shake vigorously to mix. The mustard and water should be thoroughly mixed before use. Demonstrate how to pour the mustard slurry (start pouring, but let the students finish) so that it stays inside of the sampling quadrat.

- Pour *one third* to *half* the slurry slowly so that the mixture soaks into the ground and doesn't run off.
- Choose carefully where to pour the slurry to ensure equal distribution across the site.
- Add the remainder of the slurry onto the site once the initial slurry has soaked in. Be sure to pour all of the slurry into the square.

Send teams to do this step. Then students should stay at their sites to watch for worms.

f. Discuss the scientific process that will allow for comparing the data (changing only the intended variables):

- All of the slurry should be used in the site.
- Only those earthworms that come up in the quadrat can be counted.

g. Discuss how to handle the earthworms.

- Avoid harming worms. Their bodies are very soft and should be handled very gently. Wait to see both ends of the worms out of the ground before picking them up.
- Rinse all earthworms in the clean water in the plastic tray right away. Students will only count the ones that emerged inside of the sample site.

5. Allow about 15 minutes after pouring slurry to count the worms. Circulate among the teams, helping as needed. Remind the students that finding zero worms is valuable information. Discuss with them possible explanations for finding no worms.

DISCUSSION (5-10 minutes)

Group Guides will find most of these questions on their guide cards in the activity kits.

Encourage the students to reflect on their observations.

- ☐ Did all the worms look the same?
- ☐ Did you find any other animals?
- ☐ What habitat and environmental factors did you observe in each sampling site.
- ☐ How many worms were found in each site? What conclusions can be made from the number of worms found in those sites?
- ☐ What did you learn about earthworm habitats?
- ☐ What did you discover that surprised you?

STUDENT JOURNAL (5-10 minutes)

Have the students complete the Worm Worlds *Week 1* worksheets in their field journal.

CLEAN UP

The importance of clean-up is critical to the smooth operation of the program. Children are expected to help.

1. Return worms to an adjacent spot (away from direct sunlight; not where slurry was poured).
2. Wrap the strings around all hand lenses and return them to their plastic bag in the kit.
3. Wrap quadrat string carefully around the chopsticks.
4. Put the activity materials back into the kit.
5. Rinse mustard slurry jugs and trays when back inside building.
6. Children should wash their hands before going to their next activity.

CONCLUSION by TEAM LEADER (5 minutes)

After all the field groups have returned to the classroom, the Team Leader will do a brief wrap-up discussion at the end of the lesson.

Concluding questions

- How did the environmental factors and habitats of the sites differ?
- What habitat factors might explain the differences you found in worm numbers?
- What makes for a healthy worm habitat?
- What do you predict you will find when we do this activity in a different habitat next week?

~ ~ ~

Week 2: INTRODUCTION by TEAM LEADER

The Team Leader will introduce the lesson to the entire class before dividing the students into their small field groups. For this lesson, reiterate the ground-rules from last week and describe how this week will complete their investigation.

Discuss the scientific process that allowed for comparing the data (changing only the intended variables):

→Last week we conducted an investigation. What parts of the investigation were the same across all plots?

1. We all had the same sized plot.
2. We used all of the slurry.
3. Only those earthworms that came up in the quadrat could be counted.
4. The time of day and weather were the same.

→What part of the investigation were different?

•We studied different habitats with some different environmental factors.

Today we are going to choose study sites with different environmental factors than those we studied last week to see how environmental factors can affect worm populations.

Week 2, OUTDOOR ACTIVITY by VOLUNTEER GROUP GUIDE

The Group Guide will complete the activity with their small field group as described below.

TELL ME (5 minutes)

Gather the students into a circle and point out the study site boundaries

Have them open their notebooks to review the environmental factors they observed last week. Have each group report out the environmental factors present in their study areas:

- Weather conditions
- Hardness/softness of soil
- Slurry absorption
- Air temperature

State the challenge: Today we will do a follow-up investigation at a site with a different environmental factors, compare our findings from each site, and write a conclusion for our investigation.

ACTION (20 minutes)

1. Reiterate the boundaries of your study site.

***2.* Repeat the actions steps 1-5 from *week 1*.**

DISCUSSION (5-10 minutes)

Group Guides will find most of these questions on their guide cards in the activity kits.

Encourage the students to reflect on their observations.

- ☐ How did the environmental factors and habitats of the sites differ?
- ☐ How many worms were found in each site? What conclusions can be made from the number of worms found in those sites?
- ☐ What environmental factors might explain the differences you found in worm numbers?
- ☐ What did you predict? Did the evidence support your prediction? Why or why not?
- ☐ What did you learn about earthworm habitats?
- ☐ What did you discover that surprised you?

STUDENT JOURNAL (5-10 minutes)

Have the students complete the Worm Worlds *Week 2* worksheets in their field journal.

CLEAN UP

The importance of clean-up is critical to the smooth operation of the program. Children are expected to help.

1. Return worms to an adjacent spot (away from direct sunlight; not where slurry was poured).
2. Wrap the strings around all hand lenses and return them to their plastic bag in the kit.
3. Wrap quadrat string carefully around the chopsticks.
4. Put the activity materials back into the kit.
5. Rinse mustard slurry jugs and trays when back inside building.
6. Children should wash their hands before going to their next activity.

CONCLUSION by TEAM LEADER (5 minutes)

After all the field groups have returned to the classroom, the Team Leader will do a brief wrap-up discussion at the end of the lesson.

Wrap Up

- Habitat and environmental factors determine where earthworms are likely to live.
- Earthworms are decomposers.
- You can repeat this investigation anywhere outdoors that is not paved. We used a 1-gallon milk jug, powdered mustard that you can get from any grocery store, and you can use any tray for the worm spa. Try the investigation at different times of day, at different times of the year, and in different habitats.

Concluding questions

- How did the environmental factors and habitats of your sites differ?
- What environmental factors might explain the differences you found in worm numbers?
- What makes for a healthy worm habitat?
- What did you discover that surprised you?

This is our last FUN lesson and we learned many things about our schoolyard habitat. Each time we met you worked as certain scientists, what did you learn as an engineer (Bird Nests), an entomologist (Litter Critters), and an oligochaetologist (Worm Worlds)?