Worms in the Classroom

Educator Resources

LOWER PLATTE SOUTH NRD
(402) 476-2729
www.lpsnrd.org

All About Worms

Red Worms

Eisenia Foetida

This variety is the best redworm for home composting. They produce a large amount of compost in their natural habitats of leaves, manure, compost piles and in many other decaying organic materials. They are typically not found in the soil of gardens.

Reproduction

Redworms are hermaphorditic which means each worm has both male and female reproductive organs. Mating is, however, still necessary. If the worm has a swollen band about one third between head and tail, this means that the worm is sexually mature. The swollen bans is known as a clitellum and is used for mating. They may mate at any time of the year.

When red worms mate, they lie with their heads in opposite direction, bodies closely aligned. Sperm, produced in the clitellum, are exchanged between the worms. Some time after the worms have separated, the clitellum secretes another substance called albumin. This material forms a cocoon in which the eggs are fertilized and baby worms hatch.

Redworm cocoons are round shaped and small. They change color during their development, first white, becoming yellow, later brown. When new worms are ready to emerge, the cocoons turn red. It takes at least three weeks for the worms to develop in the cocoon. Temperature and other conditions are factors in the development of the hatchlings. Although a cocoon might hold as many as 20 eggs, usually only 3 or 4 worms will emerge. The young hatchlings are whitish with a pink tinge showing their blood vessels.

Benefits of Worms

Red worms create extremely rich, high-nutrient compost. The compost consists of worm castings. Castings are worm manure or excrements. These castings are a wonderful source of nutrients or fertilizer for the soil.

Conditions that determine Red Worm population

If worms have to compete for food, the population will go down. If there is a lot of food available for a time, then worms multiply at a high rate creating more worms. These new, young worms then compete with their parents. This greater population produces more castings. To solve the problem you can feed them more food, but you might also need a larger box for the greater numbers of worms. It's important to note that castings are toxic to their own species, so it is advisable to harvest the castings regularly.

Worm Facts

• Earthworms have no eyes or ears, but they have light-sensitive cells that help them tell the difference between light and darkness. Worms will move away from light and will become paralyzed if exposed to light too long (approximately 1 hour).

• Worm's bodies are sensitive to vibrations and worms can "feel" shovels and foot steps on the soil.

• Worms can be good for gardens and farmland. By tunneling through soil, they drain water, bring in oxygen, and create space for plant roots.

• At night worms often come to the surface and deposit mounds of castings ("worm poop") small pellet-like piles of organic matter that have passed through the worm's digestive tract.

• An acre of good garden or farm soil may be home to a million earthworms.

• Were earthworms always here? Yes and no. During the time that glaciers covered much of North America, earthworms disappeared from the frozen soil. It would have taken centuries or longer for earthworms to become re-established on their own, but human actions sped up the process. Farmers and gardeners brought potted plants from other places for planting, inadvertently releasing earthworms that were in that soil. And when farmers tilled the soil to make it easier for tiny roots to grow, they also made it easier for the worms to tunnel through the soil. As worms increased, so did robins. In 1932, a scientist named Frank Farley found that robins had increased 100 percent in Alberta, Canada in the 50 years since the 1880s.

• Earthworms get their nutrition from many forms of organic matter in soil. They eat decaying roots and leaves, and tiny organisms such as nematodes, protozoans, rotifers, bacteria, and fungi. Worms also feed on the decomposing remains of other animals. An earthworm can consume up to one-third of its own body weight in just one day!

• There are approximately 2,700 different kinds of earthworms.

• Worms tunnel deeply in the soil and bring subsoil closer to the surface mixing it with the topsoil. Slime, a secretion of earthworms, contains nitrogen. Nitrogen is an important nutrient for plants. The sticky slime helps to hold clusters of soil particles together in formations called aggregates.

• Worms are cold-blooded, or exothermic, animals.

• Baby worms are not born. They hatch from cocoons smaller than a grain of rice.

• Worms are hermaphrodites. Each worm has both male and female organs. Worms mate by joining their clitella (swollen area near the head of a mature worm) and exchanging sperm. Then each worm forms an egg capsule in its clitellum.

Children's Books: Worms

Wiggling Worms at Work
by Wendy Pfeffer (Author) and Steve Jenkins (Illustrator)
Reading level: Ages 4-8
Paperback, 40 pages
Publisher: Collins; 1 edition (2003)
ISBN-10: 0064451992 ; ISBN-13: 978-0064451994

An Earthworm's Life
by John Himmelman (Author)
Reading level: Ages 4-8
Paperback, 32 pages
Publisher: Children's Press (2001)
ISBN-10: 0516265350 , ISBN-13: 978-0516265353

Wonderful Worms
by Linda Glaser (Author)
Reading level: Ages 4-8
Paperback, 32 pages
Publisher: Millbrook Press (1994)
ISBN-10: 1562947303 ; ISBN-13: 978-1562947309

Earthworms
by Claire Llewellyn (Author) and Barrie Watts (Author)
Reading level: Ages 4-8
Paperback: 32 pages
Publisher: Children's Press (2002)
ISBN-10: 0531148254 ; ISBN-13: 978-0531148259

Garden Wigglers: Earthworms in Your Backyard
by Nancy Loewen (Author), Rick Peterson (Illustrator)
Reading level: Ages 4-8
Paperback, 24 pages
Publisher: Picture Window Books (2003)
ISBN-10: 1404817573 ; ISBN-13: 978-1404817579

Compost By Gosh!
by Michelle Eva Portman (Author)
Reading Level: Ages 4-8
Hardcover, 32 pages
Publisher: Flower Press (2002)
ISBN-10: 0942256166; ISBN-13: 978-0942256161

Diary of a Worm
Doreen Cronin (Author) and Harry Bliss (Illustrator)
Reading level: Preschool- 3rd grade
Hardcover; 40 pages
Publisher: HarperCollins (2003)
ISBN-10: 006000150X ; ISBN-13: 978-0060001506

Dirt: The Scoop on Soil
by Natalie M Rosinsky (Author), Sheree Boyd (Illustrator)
Reading level: Ages 4-8
Paperback, 24 pages
Publisher: Picture Window Books (2002)
ISBN-10: 1404803319; ISBN-13: 978-1404803312

Dirt: Jump Into Science
by Steve Tomecek (Author), Nancy Woodman (Illustrator)
Reading level: Ages 4-8
Hardcover, 32 pages
Publisher: National Geographic Children's Books (2002)
ISBN-10: 0792282043 ; ISBN-13: 978-0792282044

Composting: Nature's Recyclers
by Robin Koontz (Author), Matthew Harrad (Illustrator)
Reading level: Ages 4-8
Paperback, 24 pages
Publisher: Picture Window Books (2002)
ISBN-10: 1404822003; ISBN-13: 978-1404822009

A Handful of Dirt
by Raymond Bial (Author, Photographer, Illustrator)
Reading level: Ages 9-12
Hardcover, 31 pages
Publisher: Walker Books for Young Readers (2000)
ISBN-10: 0802786987; ISBN-13: 978-0802786982

Educator Resource Books: Worms

Worms Eat My Garbage: How to Set Up and Maintain a Worm Composting System
by Mary Appelhof
Publisher: Flower Press; 2 edition (1997)
ISBN-10: 0977804518
ISBN-13: 978-0977804511

Worms Eat Our Garbage: Classroom Activities for a Better Environment
by Mary Appelhof; Mary Frances Fenton; Barbara Loss Harris
Publisher: Flowerfield Enterprises (1993)
ISBN-10: 097780450X
ISBN-13: 978-0977804504

The Worm Cafe, Mid-Scale Vermicomposting of Lunchroom Wastes
by Binet Payne
Publisher: Flower Press (1999)
ISBN-10: 0942256115
ISBN-13: 978-0942256116

Let it Rot!: The Gardener's Guide to Composting
by Stu Campbell
Publisher: Storey Publishing (1998)
ISBN-10: 1580170234
ISBN-13: 978-1580170239

The Worm Book: The Complete Guide to Gardening and Composting with Worms
by Loren Nancarrow and Janet Hogan Taylor
Publisher: Ten Speed Press (2004)
ISBN-10: 0898159946
ISBN-13: 978-0898159943

Websites: Worms

• The Adventures of Herman the Worm
www.urbanext.illinois.edu/worms/index.html
An interactive site for children dealing with earth worms. This site teaches the body parts and why worms are important.

• Minnesota Museum Magnet School Worm Unit for First Grade
www.thinkingfountain.org/w/worms/worms/worms.html
Discover how this first grade classroom studied worms through songs, books, and experiments.

• Cornell Composting: Composting in Schools
www.compost.css.cornell.edu/schools.html
This site is maintained by the Cornell Waste Management Institute at Cornell College. There is lots of good information for teachers.

• Do the Rot Thing!: A Teacher's Guide to Compost Activities
http://www.cvswmd.org/wp/wp-content/files/pdf/Do_the_Rot_Thing_CVSWMD1.pdf
A free, 68-page downloadable activity guide for teacher to help with a worm and conposting unit.

• Earthworm Project
www.fi.edu/sln/school/tfi/spring96/worms.html
Lots of good links and information on earthworms and composting.

How to Make a Worm Bin

Materials
One 10-12 gallon plastic storage box (dark, not see through!)
Drill (with 1/4" and 1/16" bits) for making drainage & ventilation holes
Newspaper
About one pound of red worms

Step 1
Drill 20 evenly spaced $^{1}/_{4}$ inch holes in the bottom of the bin. These holes will provide drainage.

Step 2
Drill ventilation holes about 1 – 1 ½ inches apart on each side using the $^{1}/_{16}$ inch bit; leave room at the bottom of the container (about 4 inches) without holes so worms do not get out. Also drill about 30 small holes in the top of the lid.

Step 3
Prepare bedding for the worms by shredding newspaper into 1 inch strips. Worms need bedding that is moist but not soggy. Moisten the newspaper by soaking it in water and then squeezing out the excess water. Cover the bottom of the bin with 3-4 inches of moist newspaper, fluffed up. If you have any old leaves or leaf litter, that can be added also. Throw in a handful of dirt for "grit" to help the worms digest their food.

Step 4
Add your worms to the bedding.

Step 5
Place your bin in a well-ventilated location. Place the bin on top of blocks or bricks to allow for drainage. You can use another container lid as a tray to catch any moisture that may drain from the bin. Do not use the lid for your container as it needs to stay on the bin at all time when not in use to prevent excess evaporation.

Step 6
Feed your worms slowly at first (see "What Do Worms Eat" in your Educator Resources packet). As the worms multiply, you can begin to add more food. Gently bury the food in a different section of the bin each week, under the cardboard. The worms will follow the food scraps around the bin. Burying the food scraps will help to keep fruit flies away.

What do Worms Like to Eat?

Feed your worms a vegetarian diet. Most things that would normally go down the garbage disposal can go into your worm bin (see the list below). You will notice that some foods will be eaten faster than others. Worms have their preferences just like us.

Worms LOVE
Breads & Grains
Cereal
Coffee grounds & filter
Fruits
Tea bags
Vegetables

Worms HATE
Dairy Products
Fats
Meat
Feces
Oils

Worm Bin Troubleshooting

Problem: Worms are dying or trying to escape
Probable Causes: bedding is too wet, bedding is too dry, bedding is used up
Solution: Add more bedding, moisten bedding, harvest your compost and move worms to a new bin.

Problem: Bin stinks!
Probable Causes: Not enough air, too much food, too wet
Solution: Drill more ventilation holes, do not feed for 1-2 weeks, add more bedding

Problem: Fruit Flys
Probable Cause: Exposed food
Solution: Bury food in bedding

Activity 1: Getting to Know Your Worms

Materials:
- copies of “Warming Up to Worms” sheet - one per student or group of students
- damp paper towels - one per student or group of students
- worms - one per student or group of students
- magnifying lenses - one per student or group of students (optional)

Procedure:

1. Give each student or group of students a copy of the “Warming Up To Worms” Sheet and a damp paper towel. Allow students to get one worm from the composting bin. Ask students to observe their worm for several minutes.

You may want to provide students with a magnifying lens to observe their worms up-close.

2. Once students have “warmed up” to their worm, have them answer the questions on the sheet. When students have finished exploring their live worm, have them carefully return the worm to the Worm Bin.

3. Once students are finished with their sheet, start a classroom discussion about the student’s observations about the worms. Ask students:
    - What does the worm feel like? How would you describe the feeling of the worm to a friend?
    - Can you tell which is the head and which is the tail of the worm? How can you tell?
    - How does touching and investigating the worm make you feel?
    - Where might you find a worm like this in nature?
    - What function do worms like this serve in nature?
    - After observing the worm, what questions do you have?

4. Following the class discussion, ask students to draw a picture of their worm.

Name: _____

Warming Up to Worms

1. What color is the worm?

_____

2. What shape is the worm?

_____

3. How does the worm feel?

_____

_____

4. Can you tell which is the head and which is the back end of the worm? Describe your observations?

_____

_____

5. After observing your worm, what questions do you have?

_____

_____

_____

Activity 2: What's for dinner?

Materials:
- one classroom worm composting bin with 75-100 red worms and bedding material
- copies of "Worm Feeding Record Sheet" sheet - one per student
- food scraps (see "What Do Worms Like to Eat" in the Educator's Resources packet)

Procedure:
1. Once students are familiar with the worm composting bin and the red worms inside, explain to students that they are going to investigate how worms "eat" food scraps and turn it into compost or soil.

2. Ask students what they think the worms would like to eat. Start a list on the board or a large sheet of paper. Ask students what they think worms would not like to eat. Make a list of this as well. Do not tell students, throughout the activity, the students will learn what worms actually like to eat and what they actually do not like to eat.

Give each student a copy of the "Worm Feeding Record Sheet."

3. Begin the activity by selecting one item from each of the lists the students made (Step 2) to be placed in the worm bin. Have students measure how much is being placed in the worm bin (i.e. 1 large carrot, one cupcake, $^{1}/_{2}$ potato). Place each of these items in the worm bin and bury it under the worm bedding material. Note: If the food is on the "What Worms Like to Eat - Worms HATE" list (see "Making A Worm Bin in the Educator's Resources Packet), put only a small amount in the worm bin to avoid "contaminating" the whole bin.

4. Help students fill-out their "Worm Feeding Record Sheet." Be sure to include the amount of each food scrap put in the bin, what the food looked like, and where in the bin it was placed.

5. After several days, have students un-bury the food scrap and make observations as to how much has been eaten, what the food looked like before and what it looks like now. Have students make a determination as to whether the worms "liked" or "disliked" each of the items.

6. Re-bury the food scraps in the same location as before. Decide on another food scrap to observe.

7. Follow the same steps of observing, recording, placing, waiting, and re-observing another food scrap.

8. After several food scrap items have been observed, make a new list of what worms "like" and "dislike" as in Step 2.

Worm Feeding Record Sheet Name:_____

Date	Food Item	Amount in Worm Bin (start)	Date	Amount in Worm Bin (now)	Do Worm Like It?

Activity 3: Worms... Nature's Recyclers!

Materials:
- copies of "Nutrient Cycle Coloring Sheet" - one per student
- scissors
- crayons or colored pencils
- glue or glue sticks
- paper ($8^1/_2$ x 11) - one per student

Procedure:

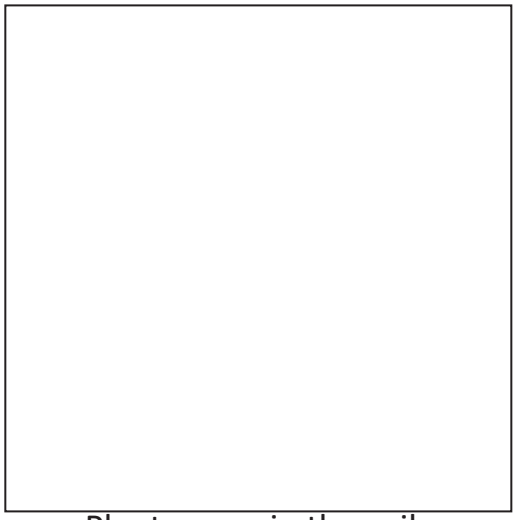
1. Begin the activity by starting a classroom discussion. Ask the students:
    - What is a nutrient? (food, but more specifically, calcium, potassium, iron, nitrogen, and phosphorus are just a few of the many nutrients we get from food.)
    - Where do we get our nutrients? (food, farms, ranches, the grocery store.)
    - Do trees go to the grocery store to get their food/nutrients? (no!)
    - Where do plants get their food/nutrients? (soil)
    - Do plants ever run out of food/nutrients? (The answer is generally no.)
    - Why don't plants run out of food? (Typically in a healthy ecosystem, there are plenty of nutrient in the soil due to decomposition of dead materials which provide food for living plants and animals.)
    - What things are involved in the nutrient cycle? (living plants and animals including decomposers like worms and insects, soil including nutrients.)

2. Give each student a copy of the "Nutrient Cycle Coloring Sheet." Ask students to draw a picture of each step of the nutrient cycle.

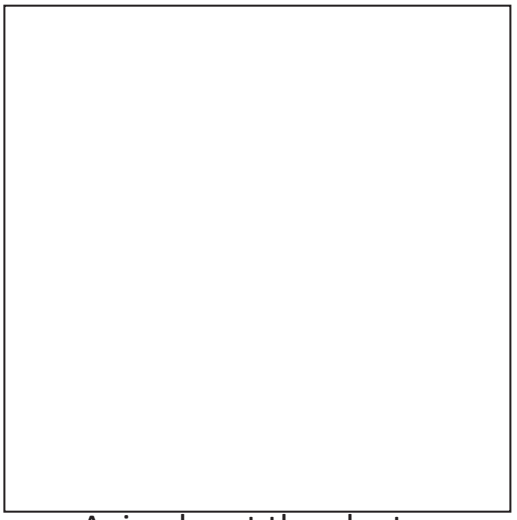
3. Once students have completed the "Nutrient Cycle Coloring Sheet" have another classroom discussion. Ask the students:
    - What would happen if there were no decomposers like worms and insects? (The nutrient cycle would stop and the dead plant and animals would not decompose. This would lead to no "new" soil being created and eventually all the living plants and animals would run out of nutrients or food.)
    - Have you ever seen a worm in nature? Where do they live? Why do they live there?
    - How are humans part of this cycle?

Nutrient Cycle Coloring Sheet

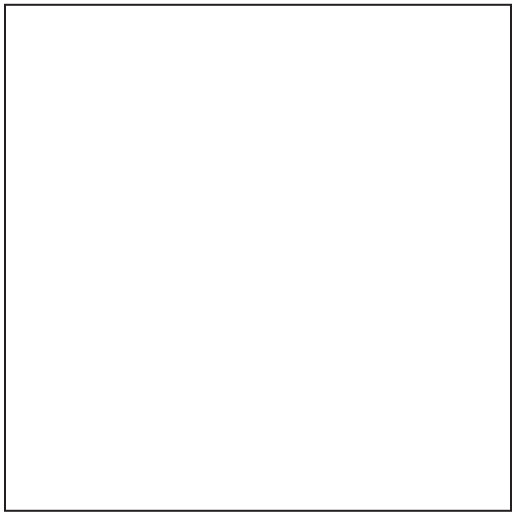
Name:_____



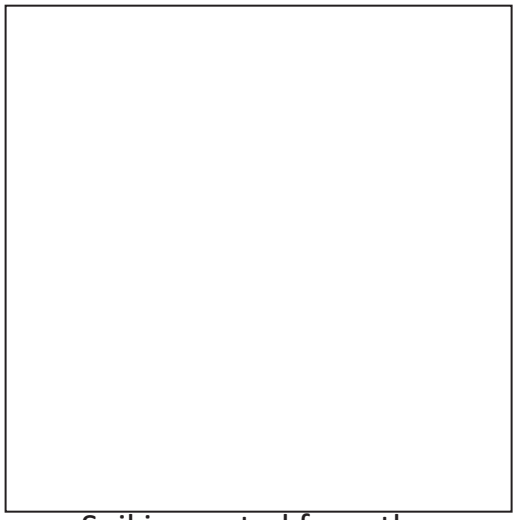
Plants grow in the soil.



Animals eat the plants.



Decomposers (worms, and bugs) eat dead plants and animals.



Soil is created from the worms and bugs.

- EXAMPLE -

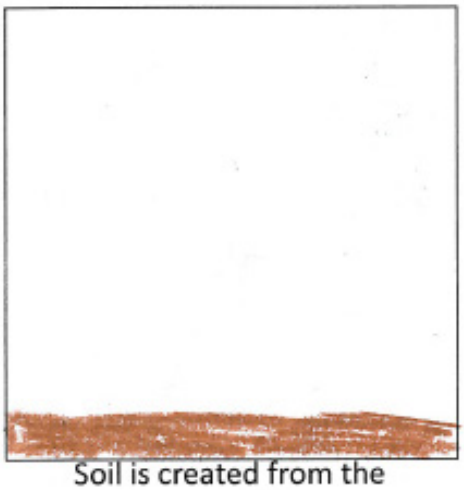
Nutrient Cycle Coloring Sheet

Name: Susan

Plants grow in the soil.

Animals eat the plants.

Decomposers (worms, and bugs) eat dead plants and animals.



Soil is created from the worms and bugs.

Activity 4: Measuring Worms

Materials:
- gummy Worms - 2 or 3 per student
- Cheerios, beans, or other non-tradition measuring unit
- live worms from Worm Bin
- rulers
- damp paper towels

Procedure:
1. Begin by giving each student 2 or 3 gummy worms and a handful of Cheerios or dry beans. Ask them to measure their gummy worm using the non-traditional measuring units. For example, “My worm is 6 Cheerios long,” or “My worm equals 4 dry beans.” If the gummy worms have different color segments, have students measure each different segment as well as the total worm length.

2. Once students have completed measuring their gummy worms with the non-traditional measurements, ask students how long was their gummy worm? Ask students if all Cheerios are exactly the same size (No!). If all Cheerios are not the same size, are Cheerios an accurate means of measuring length?

3. Next give students a ruler. Ask students to measure their gummy worms again this time using the rulers. Again, if the gummy worms have different color segments, have students measure each different segment as well as the total worm length.

Have student record their gummy worm lengths on a piece of paper. Be sure they include units (inches, centimeters, etc).

4. Once students are ready to measure the live worms, give each student a damp paper towel and a live worm. Ask students to measure the live worm just as they did with the gummy worms.

5. Have students record their live worm measurements on the front board. Again, be sure they include units.

6. Once students are finished measuring their live worm, have them carefully return the worm to the Worm Bin.

7. Finish the activity with a class discussion. Ask students:
    - Which means of measuring is more accurate – the Cheerios or the ruler?
    - Which was easier to measure – the gummy worm or the live worm? Why?
    - How did the live worm move?

8. If students are ready, begin a discussion on averages and as a class, compute the average length of your gummy worms and live worms.

Activity 5: Worm Memory Game

Procedure:

1. Cut-out each picture, laminate if possible. Mix up the pictures and lay face down on a table. Put pictures in several rows.

2. Have students play a memory game with the pictures, when a student gets a match, they keep the two pictures. The game is over when all matches have been made. The winner of the game is the player with the most matches.

Worm Memory Game, continued






Worm Memory Game, continued






Worm Memory Game, continued






Worm Memory Game, continued