



Project Option B
Worms Ate My Lunch
Project Guide
Chicago Conservation Corps (C3) Student Clubs



By participating in this project, Club members will:

1. Learn about an alternative method of waste disposal.
2. Build a functioning vermicompost bin.
3. Have the opportunity to educate others about alternative methods of waste disposal.

Overview

For this project, your Club is going to build and maintain a vermicompost bin. This will require that your Club members develop a strong understanding of worm diet and collect food scraps (either from home or from school). Club members will be keeping track of what the worms are fed, and will occasionally harvest the compost from the bin.

Things to keep in mind:

- **Time commitment:** Building and preparing the worm bin will take no more than a few hours. After that, you will generally need several minutes per day for maintenance and observations.
- **Worm care:** Your Club will need to feed the worms regularly. The worms should be fine over weekends and most holidays, but a worm caretaker should be organized for longer breaks.
- **Amount of waste you can divert:** Worms eat about half their weight in food every day. Your bin that will comfortably hold about one pound of worms, so you will want to regularly collect about ½ pound of food to start, then gradually increase as the worms multiply.
- **Compost:** The worms create moist, rich compost that should be harvested from the bin soon after it is ready, and should be used within a few days of harvesting.

Materials:

To be provided by DOE at the Land & Waste Workshop:

- Plastic storage bin (10-18 gallons, approximately 25.5" x 17.5" x 15.4")
- Approximately one pound of red worms, *Eisenia Foetida*. (See below for details).

To be provided by the Club:

- Drill with 1/16 in. bit (to make ventilation holes in bin)
- Black-and-white newspaper scraps
- Optional: scale for weighing food

The online report for this audit is due:
Friday, January 9th

To submit your report, log-in at
www.chicagoconservationcorps.org
(click on “C3 Teachers”)

Note: Teacher stipend check is contingent on the timely completion of the report.

For questions or concerns, contact:

Jeff Walter

Chicago Department of Environment

312-743-9283

conservation@cityofchicago.org

Why should we do this project?

Food scraps make up **12% of the waste** that Americans generate every day. That adds up to about **28 million tons of food** that are thrown out over the course of a year! Food scraps that are sealed in airtight landfills can react with other materials and **create methane** (a greenhouse gas) and **acidic leachate** (liquid that accumulates in landfills and can enter nearby ecosystems).

Composting can prevent the above issues, while also doing some additional great things for your local environment. Compost can help **remediate soil** that has been contaminated with hazardous waste. Plus, using compost **costs 50% less** than traditional remediation technologies.

Vermicomposting (or vermiculture) is one form of composting that uses worms to turn organic food waste into a nutrient-rich soil called vermicompost. Worms eat the decaying food and transform it into castings (i.e. worm poop) that are full of the **nutrients and bacteria** that gardens and houseplants love. Vermicomposting is a great way to compost in an urban setting where other types of compost bins may not be practical (e.g., outdoor bins at your school or home). So, the question is really why **shouldn't** you do this project?



Build and Maintain a Worm Bin

Part I: Plan for Your Worm Bin (*1 meeting*)

1. Read through this entire procedure. Contact DOE staff with any questions.
2. Go through this procedure **with all of the Club members**, also discussing the importance and value of composting (see some of the materials on the Additional Resources List at the end of this guide for more information).
3. Consult with **administrators** and building **engineers** to ensure that keeping a worm bin in the school is appropriate.
 - Remind them that the bin will not smell or attract pests if it is maintained properly, and outline your plan for maintaining the bin, including:
 - Designating Club members to maintain the bin.
 - Monitoring the amount of food that is placed in the bin and the condition of the bin.
 - Designating Club members to take the bin home over long breaks.
 - Feel free to use or modify DOE's sample memo to help you explain the bins.
4. Determine **where** you will place the bin.
 - Worms prefer moderate temperatures (between 55°F and 77°F), so find a place for the bin somewhere where it will not freeze or overheat.
 - The bin should be small enough to fit in a corner of your classroom. Worms prefer darker locations – they usually live underground, so they don't like the light!
5. Remind Club members to bring some black-and-white **newspaper** to the next meeting. Warn them not to bring colored pages or slick paper which can be toxic to worms.

Part II: Prepare Your Worm Bin (*1 meeting*)

1. Use the 1/16-inch bit to **drill ventilation holes** about 1 to 1.5 inches apart along the side of the bin, close to the top. Also drill 8-10 holes in the bin's top.
2. Prepare **bedding** materials. Bedding provides the medium in which worms live, holds the moisture and provides the air worms need to survive, and covers the garbage you bury.
 - Tear black and white newspaper into long strips about 1 inch wide. Fill the bin with the strips. The paper should be well-fluffed – don't pack it in.
 - Add just enough water to moisten the paper so it is about as damp as a wrung-out sponge.



3. Determine sources of **food scraps** for your worms.

- Review the list of food that worms love and hate on this page to the right.
- Your Club will want to regularly collect about ½ pound of food per day.
 - You can borrow a scale from the science lab to weigh the food, or just estimate.
 - ½ pound of food is about 8 slices of bread or 1½ cups of sliced fruit or vegetables.
- Some potential sources might include:
 - Club members bringing food from home.
 - Collecting food from Club member lunches.
 - Setting out collection trays in teachers' lounges (e.g., fruit scraps, coffee grounds).
 - Working with cafeteria staff to collect scraps from food preparation.

4. Determine Club member **responsibilities**. Who will be responsible for:

- Collecting food?
- Feeding the worms and making observations?
- Taking the worms home over long holidays and summer vacation? The worm bin may be too heavy for one person to carry, so plan ahead for transport.
 - Note: The worms will not need to be fed on the weekends – there will be plenty of food in the bin by that point from the rest of the week.

5. Remind Club members to bring a few **handfuls of food scraps** to the next meeting to feed the worms as they enter their new home!

6. **Teacher task** as soon as the Club's bin is ready: order worms from our vendor. Talk to a C3 staff member for more information on this process.

Worms LOVE...

- Vegetable scraps.
- Fruit peelings.
- Bread and grains.
- Tea bags.
- Coffee grounds and brown paper filters.
- Well-crushed eggshells.

Worms HATE...

- Meat, bones, fat.
- Dairy products.
- Rubber bands.
- Twigs and branches.
- Dog and cat feces.
- Greasy foods.
- Plant materials (such as banana peels) that have been sprayed heavily with pesticides.
- Too much of any one food!
Worms like diversity in their diet, just like you.

TEACHERS: Ordering Worms

For more information about the C3 process for ordering worms, please contact a C3 staff member at conservation@cityofchicago.org.

You will need a pound of Red Wrigglers. We work with a specific vendor, but if you would like to purchase your worms independently, they can be obtained at any bait shop or on-line at www.wormwoman.com.



Part III: Start Your Worm Bin (1 meeting)

1. Add **one pound of worms** to your prepared worm bin.
 - You can just place the worms in the bin – they will move to the spot in which they are most comfortable.
2. Add a **handful or two of food** for the worms' first meal. See Part IV for more information about feeding the worms.
3. **Cover** the contents of the bin with a whole sheet of damp newspaper in order to keep any fruit flies that arrive with food scraps from escaping.
 - You will need to lift this sheet in the future to add worms and food.
4. Put the **lid** on the bin.
 - Worms are very light sensitive, so the lid should be placed on the bin at all times except during feeding and maintenance.
5. Start your Club's **Worm Bin Observation Sheet** (see worksheet).
6. Club members should make easy-to-understand **signs** that describe what can and cannot go in the bin.



Part IV: Feed and Maintain Your Worm Bin (Ongoing)

Some basic guidelines for keeping your worm bin healthy are listed below.

Feeding:

- Make sure to refer to the foods that worms love and hate on page 3.
- Bury the waste in pockets, rotating around the bin as you go. Most of the food should have been eaten by the time you return to the first spot. If not, cut back on the amount of waste you add.
- Begin feeding the worms **a little at a time**. Remember that worms eat about half their weight a day.
 - This means that you can add more food as they multiply.
 - Note: It takes the worms a few weeks to become comfortable in their new homes, so they probably won't eat very much during this time. Don't worry!
- **Chop** the food into small, 1- to 3- inch pieces.
- Always **record** how much food you add on the Worm Bin Observations sheet, and how much activity there is in the worm bin (e.g., how much food has been eaten/remains, if the bin is too wet, if the bin has a strange smell, etc.).
 - You will share how much total food you diverted from the waste stream with the DOE. You can find this information by adding together the totals from every one of your observation sheets.
 - Referring to this sheet will help you troubleshoot if something does not seem quite right, or let you know when you can start adding more food.
 - If you have access to a scale, you might even consider weighing the food that you put into the bin so that you have a more accurate measurement. Your school's science lab might have a scale you can borrow.



Maintenance:

- There may be excess liquid (called “worm tea” or “compost tea”) in your bin. This should be removed to keep your worms from drowning.
 - You can remove the liquid with a turkey baster or by carefully pouring the liquid out of the bin (making sure to keep everything else in). This liquid makes a great, potent fertilizer for both indoor and outdoor plants. The tea is very potent; consider diluting it first.
 - If you do not have a use for the worm tea, you can add dry shredded newspaper to the surface of the worm bin to soak up the moisture.
- After 2 to 6 months, you should start to see dark, crumbly **compost** which will need to be removed promptly. According to some worm experts, worm castings (i.e., the compost) are toxic to worms and should be harvested within a few days of its appearance. Make sure to weigh (or estimate) how much compost you generated and record it on your observation sheet. Here are some methods for compost removal:
 - *Scoop method:* If you just need a little compost, leave the top of the bin open for about 10 minutes. After the worms have wriggled to the bottom of the bin to get away from the light, scoop out a few handfuls of compost.
 - *Migrating method:* Push the compost to one side of the bin and add fresh bedding to the other side. After a month or so all the worms will have migrated to the fresh side and you can remove the old compost.
 - *Pile method:* Empty the contents of the bin onto a sheet of plastic and separate the compost into little piles. The worms will wriggle away from the light into the center of each pile and you can brush away the compost on the outside by hand.

Compost:

- We recommend using the compost to fertilize a school garden or indoor plants, or sending it home with students in small bags with a few small holes punched in the top.
- The compost will dry out rapidly after it is harvested, although you can make it last longer by storing it in a plastic bag with a few holes.
- To mulch: Apply a one-inch deep layer to the soil around plants; make sure compost is not piled against plant stems
- To amend: Mix an inch or so of compost into the soil before planting, or mix it into the bottom of seeding trenches or transplant holes.

More Information on Worms and Vermicomposting:

- Mary Appelhof’s *Worms Eat My Garbage* is considered the authoritative source on worm composting. Check out her book if you want to become an expert on worm composting.
- Earth 911’s “Vermiculture Worm Compost” is a good overview of building and maintaining worm bins.
<http://www.earth911.org/master.asp?s=lib&a=organics/composting/wormcompost.asp>
- “Cheap and Easy Worm Bin!” Includes directions and pictures.
<http://whatcom.wsu.edu/ag/compost/Easywormbin.htm>
- WormDigest.org. Everything you ever wanted to know about worms and vermiculture. Includes a discussion board.
<http://www.wormdigest.org/>
- TheGardenForums.org’s forum on vermicomposting. Look under Dirt - Dig In!
<http://thegardenforums.org/>
- This game teaches young children about vermicomposting in a fun and creative way.
www.ciwmb.ca.gov/Vermi/Game/introduction.html
- This website introduces young children to worms, discussing everything from worm anatomy and habitat to worm diet.
<http://www.urbanext.uiuc.edu/kids/>
- Shedd Aquarium’s Guide to the Care and Keeping of Worms.
http://www.sheddaquarium.org/pdf/shedd_worm_brochure1.pdf



- For houseplants: Sprinkle compost around the base of plants.
- If you do not have a use for your compost for several months, it can be frozen. However, you may sacrifice some value by doing this.
 - Part of the value of compost is in its microbial content; in other words, there are lots of healthy bacteria in the compost that your plants might not get otherwise. Freezing the compost kills those bacteria, but still leaves behind other valuable nutrients.
 - Red wigglers are non-native species to our Illinois ecosystems. If you are going to use your compost outdoors, some sources recommend that you freeze your compost to kill any tiny worms in the early stages of growth. See the University of Minnesota's Great Lakes Worm Watch at www.nrri.umn.edu/worms/action/index.html for more information.

Expanding your Land & Waste Project

Since maintaining a worm bin doesn't take much time once it's started, you may find that your Club has extra time, and needs other activities to fill up your regular, weekly meetings that are an expected part of being a C3 Club. If you have additional time, a great use of your new-found knowledge regarding land and waste issues is to educate others! Let students and staff know what they can do individually to reduce waste and have a more positive impact on the environment. You can do this by hosting mini-workshops, putting up signs, or having people sign pledges. For a detailed list of Land & Waste-related projects, refer to the "Reduce, Reuse, Recycle – Rethink" Project Guide (pages 4 and 6-7) for ideas. Feel free to use some of these ideas, or come up with your own!

Analysis (half a meeting)

1. Using the information from your Worm Bin Observation Sheets, calculate some of your impacts.
 - Calculate the total amount of food your worms consumed. This is the amount of waste you prevented from entering the landfills.
 - Calculate how much compost you harvested.
2. Discuss the results with the Club. Here are some questions you might think about:
 - What foods did we feed the worms most frequently?
 - What were some of our greatest successes?
 - What were some of our greatest challenges?
 - Considering the amount of waste our Club diverted from landfills, how could we expand the vermicompost program to get more people involved?
3. Fill out the online report for this audit, due on Friday, January 9th (see page 1 for instructions).

NOTE: We recommend typing up the answers in Microsoft Word and then pasting them into the online report, so that you can save a copy for your records.



Troubleshooting

Note: Vermicompost is not an exact science. You will learn a lot by trial and error. Don't worry if things don't seem quite right every once in a while – just adjust your behaviors accordingly. Also bear in mind that it will take some time from when you start your bin until it starts functioning at its full potential – the worms need some time to acclimate to their new home!

Problem	Probable Cause	Solution
Worms are dying	Too hot	Move bin to cooler location
	Too dry	Moisten bedding
	Too wet	Add more bedding
	Not getting enough food	Add more food
	Bedding is used up	Harvest bin and add more bedding
Bin stinks	Exposed food in bin	Bury food in bedding
	Not enough air circulation	Fluff bedding and add more
	Improper items added	Remove meat, dairy, etc.
	Too much food added	Turn contents and add bedding; stop feeding until problem goes away
Other	Mold	Mold is an active part of the worm bin; the mold helps break down the food that the worms eat. People with extreme mold sensitivities should avoid tending the bin.
	Worms trying to escape	The bin probably has other problems; troubleshoot using the above tips.
	Bin attracts fruit flies	The bin probably has other problems; troubleshoot using the above tips. Make sure the contents of the bin are covered with a sheet of damp newspaper
	Bin attracts ants	Moisten the bin and turn the contents. If the problem persists, place the worm bin on bricks or other legs, and put the legs in dishes of soapy water.

FAQs

- **Q:** What do I do if the compost is ready to harvest before we're ready to use it in our garden?
A: It is best to harvest the compost as soon as it is ready. If you store the compost too long (even in plastic bags with holes in them), it may dry out. We recommend using the compost on your or your students' houseplants and waiting for the next batch to use as you'd planned. You can also freeze the compost, though it may lose some value.
- **Q:** Will population control be a problem? Will our worms multiply out of control?
A: Your worms will not take over the classroom. The availability of food and space limit the population size. Worms reproduce quickly, but if you continue to add the same amount of food you always have, the population size will be kept in check. (Don't worry about finding dead worms in the compost though; they decompose very quickly.)
- **Q:** Can I put too much food waste in the worm bin?
A: Yes. If you put significantly more food waste in the bin than it is equipped to handle, anaerobic conditions may develop, causing odor. Aerate the bin by turning the material and stop adding food until the odor goes away.





Worms Ate My Lunch

Worm Bin Observation Sheet

Chicago Conservation Corps (C3) Student Clubs



This worksheet helps Club members keep track of the progress of their worm bin. You will **NOT** turn this sheet into the DOE, but you **WILL** turn in a final total for the food added and the compost harvested.

Note: To estimate the weight of food scraps:

1/2 lb = 8 slices of bread

1/2 lb = 1 1/2 cup of fruit or veggie scraps

Date	Amount of Food Added (in pounds)	Type of Food Added	Observations/Notes	Caretaker Name(s)
TOTAL:				

COMPOST HARVESTED:	Date:	Weight:	Note: If you do not have a scale, 1 cup of compost = ~ 1 lb. of compost.
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