



NATURE HARMONY FOUNDATION

NATURE FARM LESSON PLAN – HEALTHY SOIL

INTRODUCTION

Topic/Unit of Study: Healthy Soil

Age group: 10 – 14 years

Lesson Objective(s):

1. To observe the process of vermicomposting by viewing a worm bin time series – the same organic matter at different stages of breakdown.
2. To learn how soil invertebrates are the original recyclers and the linchpin of healthy agroecosystems.
3. To learn about the use of worms in agriculture, industry, and natural ecosystems.

Materials:

- Feeding Record Sheet (see last page)
- Ziploc bag or plastic container to collect vermicompost and seedling.
- 3 Worm composting bins from different periods in the vermicomposting process (detailed instructions under Process section)

Key Words:

- Soil invertebrates
- Vermicomposting
- Original recyclers

CONTENT TIME

Identify (~2 min.)

- Biodiversity of *soil invertebrates* like worms is rapidly decreasing as harmful human activities such as large-scale farming and deforestation are contaminating and degrading the habitat of worms – that is, soils. For example:
 - o Approximately 30% of soil on Earth is degraded.



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- Loss of worm biodiversity can threaten soil quality and its ability to support the growth of nutrient-rich foods that humans depend on for their well-being. For example:
 - o It is estimated that within 60 years there will not be enough topsoil to grow enough crops to feed the growing human population. The loss of worm biodiversity can accelerate this timeline.

Understand (~5 min.)

- *Soil invertebrates* are creatures that live the majority of their lives in soils and include species such as worms, mollusks (e.g., snails) and arthropods (e.g., spiders).
- *Soil invertebrates* are key players in maintaining healthy agroecosystems – ecosystems that have been modified by humans to support agricultural practices and the growth of food and fibers. For example:
 - o As worms tunnel through soil and organic matter, they leave their casts or feces behind which are rich in nitrogen, phosphorus, and other nutrients. Worm tunneling also helps aerate the soil and increases its ability to hold water.
 - o These tunnels create a suitable environment for plants to intake the nutrients from worm casts. This can support their root growth and their ability to absorb water and other nutrients stored deep down in the soil.
- Worms can be described as the *original recyclers* as they can break down organic matter through the process of *vermicomposting*.
 - o *Vermicomposting* is a process where various worm species like red wigglers decompose food waste and other organic matter to create a nutrient-rich fertilizer.
 - Worms can eat about 75% of their body weight every single day – which is about 2 pounds of organic matter per day. That’s about half of what humans eat in a day and worms are tiny little creatures!
 - o As the organic matter passes through a worm’s body, it is excreted as compost which can be used in small and large-scale farming to support the growth of nutrient-rich plants that we later consume and enjoy.



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Process (~10-15 min.)

1. **Showcase to students the process of *vermicomposting* in action:** There will be 3 worm bins that the Instructor will guide students through to showcase *vermicomposting*
 - **Bin #1** will feature food waste that either students dispose of into the bin themselves (food waste they have collected from home) or Instructor has prepared prior to lesson to begin the *vermicomposting* process
 - **Talk to students about the different food worms can eat:** It is important to feed your worms the proper foods to support the process of breaking down organic matter and ensure other organisms like animals and insects do not eat the food waste – which would leave your worms hungry and your soil lacking in nutrients!
 - Feed your worms:
 - Fruit and vegetable scraps and peels
 - Eggshells
 - Plain grains (e.g., cereal, bread, and pasta)
 - Coffee grounds
 - Dryer lint of natural fibers (e.g., cotton, linen, and wool)
 - Avoid feeding your worms:
 - Meat (bones, skins, and leftovers)
 - Oil and fats (e.g., butter and mayonnaise)
 - Dairy products (e.g., yogurt, milk, and cheese)
 - Large quantities of citrus and onions
 - Pet feces
 - **Bin #2** will be prepared by the Instructor 1-2 weeks before the activity takes place to showcase the *vermicomposting* process in action
 - **Key Features:** Worm population is multiplying which helps them break down organic matter efficiently and prevents a buildup of waste and odors
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- Tell students about the ideal environment worms need to break down organic matter in the worm bin:
 - Moisture-rich environment (add non-chlorinated water once a week, add food waste regularly but be careful not to overfeed)
 - Dark containers and spaces to store worm bin
 - Aeration (stir up the vermicompost once a week)
- There are numerous resources to read online about how to create and maintain your worm bin! Example: <https://www.epa.gov/recycle/how-create-and-maintain-indoor-worm-composting-bin#maintain>
- **Bin #3** will be prepared by the Instructor 2-4 weeks before the activity takes place to showcase the *vermicomposting* process in action
 - **Key features:** Worms have broken down nearly all organic matter and have excreted it as casts to create a nutrient-rich fertilizer that can be used straight away in farming/gardening to support the growth of plants.

2. Show students the Feeding Record Sheet:

- If students are in the Food Shed, they will be shown the Feeding Record Sheet that shows (1) how much the worms were fed, (2) temperature and moisture, and (3) how many worms there are and (4) how broken-down waste is.
 - If students are not in the Food Shed, they can make a worm bin at home and complete their own Feeding Record Sheet.
 - Here is a useful link that teaches you on how to make your own worm bin: <https://hgic.clemson.edu/factsheet/worm-composting/>
3. In a small Ziploc bag or plastic container, give students a few handfuls of vermicompost that they can bring home to start their own garden!



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CLOSING

Analyze and Communicate (~5 min.)

- Ask students to think about what would happen to worm biodiversity and soil quality if food waste was not disposed of properly (i.e., **not** composted) – how is recycling our food waste connected to soil health and worm biodiversity?
- Ask students who have garden at home if they think *vermicomposting* would be a useful addition to their garden and if they would consider setting up a vermicomposter?
- Ask students how much waste they think the process of *vermicomposting* can reduce.
 - o About 30% of the mass of waste can be reduced
- Ask students to describe why worms are *keystone species* – a species that supports the function and structure of an entire ecosystem and the species that live within it. Species within an ecosystem may not be able survive if that keystone species disappeared.
 - o Plants and microorganisms depend on worms to recycle nutrients in the soil that these organisms depend on to survive and thrive.

Conclusion (~5 min.)

- Ask students what might happen if all the *soil invertebrates* like worms disappeared and there was no way to break down organic matter
 - o Buildup of waste in our landfills that could contaminate water and soil
 - o How could this affect the quality of our food?
 - o How could the disappearance of worms impact the food chain?



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Table 1: Template of Feeding Record Sheet

ELEMENTS OF FOOD SHED		ANSWER
How much food are the worms fed? How often are the worms fed?		
What is the temperature of the worm bin?		
What is the moisture level of the worm bin?		
How many worms are kept in the bin? Do new worms have to be added manually?		
How broken down is the waste after 1 – 2 weeks? How broken down is the waste after 2 – 4 weeks?		