ZERO WASTE
Lessons

ZERO WASTE 1 Reduce, Reuse, Recycle, Rot

Location Garden **Time** 1 hour

Learning Objectives

Introduce concept of reduce, reuse, recycle, rot to kids: our waste habits, landfill and effect of landfill on environment, how we can reduce and recycle, what we recycle, what we can compost. Discuss how decomposition works – FBI, carbon, nitrogen, water and air. Start talking about school wide composting program

Materials

- Book – 'Garbage Helps Our Garden Grow' – Linda Glaser
- The dirt on composting' fact sheet
- Clean trash, recyclables and compostable food and garden scraps, and examples of re-usable items: water bottles, bags etc
- Gloves
- 4 Bins, 1 for compost, 1 for recycling, 1 for re-usables, 1 for trash
- Posters – reduce, reuse, recycle, rot

Standards/ Discussions

- Living and nonliving/ Renewable and non-renewable resources, and the difference between the two
- Habitat – human and FBI (Fungus, Bacteria, Invertebrates)
- The scientific process of decomposition

Activity Directions

- Have children sit in circle on rug, have all materials ready.
- Read "Garbage Helps Our Garden Grow"

Discussion Points

* **Note:** Move through each point within couple of minutes, this is an introduction, can skip a couple questions if needed

Use "The Dirt on Composting Fact Sheet" as guide

- How does garbage help our garden grow?
- Ask the students what they know about decomposition and who does that work in the garden.
- Introduce FBI, talk about the work they do and how a compost pile, or decomposing living things anywhere are their habitat
- Talk about composting food and green waste and how food can cycle from food to soil to food
- Discuss renewable/living (animal, plant, compostable) vs. nonrenewable/nonliving (man-made products, plastics, metals), recycling helps nonliving things be more renewable but there is still a limited source
- Discuss landfills and what happens when waste goes to a landfill, and when we litter – discuss that the Earth is our habitat and we have to take care of it
- Ask them what they ate for breakfast or dinner – did it come from a box? Plastic? Cardboard? What did they do with their waste?

ZERO WASTE 1 Reduce, Reuse, Recycle, Rot

What can we re-use, what do they re-use?

- Sort through trash, recyclables, re-usables and food waste
  - Have students decide which item goes where, place it in that bin with gloves on
  - Have each student write (or draw for K) in their journal one thing that is recyclable and one thing that is compostable.

Wrap Up

- Ask students what they learned
- Briefly review ideas they didn't grasp
- Ask students if they help keep their rooms, houses, or classrooms clean and why that is important
- Connect that with taking care of the Earth/ our environment with the 4 R's
- Ask them if they'd be interested in taking care of school environment with composting and recycling program….Inspire them!!

ZERO WASTE 2 Making a Compost Pile

Location: Classroom/ Under Ramada **Time:** 60 – 75 minutes

Learning Objectives

To understand why compost is important, how to build a compost pile, and the science of how it works. For our purposes, we will only be building a garden greens and browns compost pile.

Materials

- Compost Poster of the FBI and the Four Essential Ingredients
- Books from last lesson to jog their memory (Garbage Helps Our Garden Grow for K-2 and Composting: Nature's Recyclers for 3 – 6, still looking for 7 - 8)
- Pitchfork or spading fork
- "Green" and "Brown" plant trimmings (see Background Information below)
- Yard clippers
- Water
- Flat-edged shovel

Activity Description

Build a compost pile with the class

Review of Compost Basics

Compostable Review of School Items:

- Kitchen scraps/ uncooked waste from food prep
- Bread/grain products
- Most fruit (except citrus)
- Milk and yogurt
- Vegetables
- Napkins
- Paper products without wax

Non-Compostable Items at School:

- Meat of any kind
- Cheese
- Greasy food
- Plastic and other trash/ non-biodegradable items

Review why it is important to compost:

Waste reduction and healthy soil in our garden. All food that we eat comes from soil at some point.

Review Renewable/ Living/ Biodegradable vs. Nonrenewable/Non-living/ Non-biodegradable

ZERO WASTE 2 Making a Compost Pile

Review what they learned about how compost works

Decomposition is a natural process that happens in soil in forests, and with all living or natural things. Even bread is decomposing when it gets moldy.

Review that compost provides habitat for decomposers

like the FBI, and that we feed them when we provide them with healthy material to break down

Review the Decomposers or FBI

Fungus Bacteria and Invertebrates

(source: www.cambridge.gov/recycle)

- **Decomposers** break things down. They help turn organic matter like decaying plants and animals, into vitamin rich compost. Compost is created when the FBI eat and digest items such as old bread, dried leaves, and banana peels. The FBI decompose food in different ways.
- **F is for Fungus**: When bread sits around too long, it starts to grow fuzzy white or green mold. This is the work of fungus, a group of organisms or living things that include mold and mushrooms. Like our bodies, mushrooms produce powerful chemicals that break down food. These chemicals are called enzymes. As mushrooms release enzymes, they are able to dissolve organic matter around them.
- **B is for Bacteria**: Bacteria are all around us! Bacteria are living things so small that we cannot see them without a microscope. While some bacteria make us sick, other bacteria used in medicine to keep us healthy. Bacteria keep our eyelashes clean and give yogurt its sour flavor. Bacteria also help make compost. One type of bacteria warms the compost pile so that the other bacteria can survive. As bacteria break down organic matter, nutrients are released into the compost.
- **I is for Invertebrates**: Invertebrates are animals that do not have backbones. They wriggle, crawl, and slide their way through the compost pile. Invertebrates break down organic matter by chewing and grinding. Slugs, snails, spiders, worms, beetles, mites, ants, and sow bugs are some members of the invertebrate work force!
  - Each invertebrate plays a different role in the compost pile. For example, not only do sow bugs eat decaying leaves, they also carry bacteria and fungi around the pile on their rounded backs. They're sort of like taxi drivers! Snails and slugs chew rotting material into pieces small enough for other decomposers to eat, and millipedes and beetles feed directly on decaying plants and animals. Worms have a different role to play. As worms wriggle and dig through the compost pile, they aerate, or add air to the pile. This air helps keep the FBI alive.

Activity Description

Background Information

- Talk about the cycle of life and the concept of decomposition. Explain that by building a compost pile, we build a habitat for decomposers.
- Biodegradable matter is anything that can decay. Have participants give examples of biodegradable materials that they might throw away at home or at school (banana peel, dried leaves). Keep a list.
- Explain that composting is a way of recycling the materials that the participants have listed. Composting recycles materials such as yard trimmings and food waste through a process of decomposition. Bacteria, earthworms, and other creatures actually eat these materials and break them down into food that plants can eat. The end result is a rich, dark brown, earthy smelling material called compost. This compost can then be returned to the earth to help build a healthy soil and ensure more plant growth.

- Pass around a small bag of finished compost.
- Now that they have some idea what compost is, ask participants to describe possible reasons to compost. Answers may include:
  - By composting at home, we can put less in the landfill.
  - It's fun.
  - By returning biodegradable material to the soil, we are caring for the environment.
  - Adding compost to a garden improves the health of the plants and soil, which reduces the need for chemical fertilizers and pesticides.
- Explain the basics of composting. Composting works best when a compost pile contains a proper mix of the BIG FOUR: browns, greens, air, and water. Browns are materials such as dried leaves, wood chips, or sawdust. Greens are materials such as grass clip- pings and food waste. The pile is made by alternating equal layers of green and brown materials.
  If it is kept moist and aerated, the pile becomes a home for beneficial fungus, bacteria, and insects (the "FBI"). Over time, these decomposers break down the green and brown materials until you are left with finished compost.

Building a Compost Pile

- Keep talking about the FBI: With the help of micro-organisms and insects, we can take our biodegradable materials and turn them into a rich, dark soil amendment called compost. In this way, valuable nutrients are returned to nature rather than shipped away to a landfill. Composting is an excellent way to demonstrate the cycle of life: life, death, decomposition, and re-birth.
- The four essential ingredients of compost are the BIG FOUR: browns, greens, air, and water. "Browns" are dry and woody plant trimmings, such as wood chips, dried leaves, and straw. Browns are rich in carbon. "Greens" are moist vegetable and fruit scraps, green leaves, and fresh manure. Greens are rich in nitrogen. In a compost pile, you want approximately half brown materials and half green materials by volume. Decomposer organisms need air and water to break down organic matter. Turning and watering your pile provides it with the air and moisture needed for micro-organisms. The pile should be as moist as a wrung out sponge. These four ingredients create the perfect environment/habitat for the main decomposers: fungi, bacteria, and insects.
- Review with the class the four steps to building a pile:
  - **Start** with an aerated layer of sticks at bottom to bring air into pile.
  - **Chop** materials in to pieces that are six inches in size or less.
  - **Mix** browns and greens (half of each by volume).
  - **Maintain** moisture by keeping pile as wet as a wrung-out sponge.
- Include in the pile any materials students may have collected, such as orange peels, apple cores, other vegetable and fruit trimmings, and paper. You can also add plant matter from around the school, like grass clippings and leaves. Avoid diseased plants.
  - Have the participants collect the brown and green materials in separate piles (an equal amount of each works well).

- Assign students to help with each of the various tasks of chop- ping, layering greens, layering browns, mixing, and watering.
- Students can chop materials by piling up materials on the ground and using a flat edge shovel to bruise or chop pieces. Clippers can be used to cut up pieces. Ideal size is about six inches long, although any bruising is helpful. These activities should be carefully supervised.
- Build the compost pile by alternating layers of brown and green material. Add water by spraying with a hose as you add each layer. The pile should be about as wet as a wrung-out sponge.
- Stir the layers together with a pitchfork as you build the pile. Keep the pile "fluffed up" to maximize the air in the pile. (This is not necessary).
- Be sure to plan for the ongoing maintenance and eventual harvesting of the compost pile.
- Once the pile is built, review the basics of composting and why it is important.
- Always finish the pile with a layer of browns, finished compost, or soil. Don't put greens on top; this will help prevent fly nesting.

Wrapping Up

Ask the kids about what they learned: focus on why compost and how it works, FBI and Four Essential compost ingredients. If time, have them write in their journals about these topics, older grades in particular. Younger grades can draw compost pile. Always thank them for their work in the garden and at the school.

ZERO WASTE 3 Compost Exploration

Location Garden **Time:** 1 hour

Learning Objectives

Students will make careful, close observation of organisms in the garden at the micro level. Students will be able to name several ingredients needed to be able to build a compost pile.

Materials

- Each pair of students will have:
- A tray with compost placed on it
- Two magnifying glasses – older kids popsicle sticks, gloves
- Egg carton to separate different ingredients of compost into
- Garden journals and pencils – older kids
- Compost critter reference sheet to show them what kind of critters they may find

Activity Description

- Review what compost is and importance of compost – that it helps us reduce waste by decomposing food and green waste, that it happens everywhere, that the FBI (fungus, bacteria, invertebrates) help compost happen, and that key ingredients like carbon, nitrogen, air and water
- Tell students they are going to investigate the ingredients in our compost pile and see if they recognize anything (sticks, straw, leaves, veggies from garden etc). Explain that when the composting process finishes they won't be able to recognize any of these components. They will slowly rot and decay, breaking into smaller and smaller pieces until they turn into dark rich soil (finished compost). Show them finished compost.
- Encourage students to use 5 senses to explore compost. Break them into pairs or threes.
- They are also going to look for invertebrates deeper in the compost pile with trowels after sifting through their personal compost piles. Remind them that these critters help compost decompose. As groups sift through their compost, bring individual groups up to pile to investigate/ dig deeper and look for critters.
- Ask students to identify what they see in the compost and the critters they found. Have them draw and list what they found in their journals. (The older the more detailed and complicated.) have them share what they found with class.

ZERO WASTE 4 Compost Field Trips!

Location: Marin Sanitary Service **Time:** ½ Day

Learning Objectives

To give students a first hand experience at a composting and resource recovery facility.

Activity Description

- **Area 1: The Classroom**
  - After students have a few moments in the classroom to look over materials and educational features that line the walls everyone suits up in safety vests and hard-hat helmets. Before departing the classroom the children watch a short video and then there is a brief discussion on the importance of the 4 R's (reduce, re-use, recycle and rot).
- Area 2: The Marin Recycling Center
  - At the Recycling center students see firsthand what happens to recyclables once they have been collected. They will watch recyclables being separated and processed for shipment to a manufacturing plant where they will be turned into new commodities.
- Area 3: The Transfer Station
  - The Transfer Station is where residential garbage is collected daily. It is here that collection trucks are weighed before dumping their load into a huge pit. There the garbage is bulldozed and compacted before being transferred into large cargo trucks to the landfill.
- Area 4: Marin Resource and Recovery Center (MRRC)
  - All public and all "dry" commercial waste is brought to the MRRC (sometimes called the "indoor dump"). Here the waste is thoroughly sorted through, diverting all recyclable resources from the garbage before it ends up in the landfill.
  - Over the last several years MRRC has averaged a 74% recovery rate, meaning 74% of materials brought to the MRRC are diverted from the landfill. As students exit this area they will briefly stop at the Household Hazardous Waste facility to hear an explanation of its purpose and importance, as well as how it functions.
- Area 5: The Flying Can Ranch
  - The Ranch is the last stop, where pigs and other farm animals live. Everyone enjoys this part of the tour, not just because the children get to feed the animals, but it is important to find out why we raise them and what important role they play in recycling. The tour concludes back in the classroom for a review about recyclables and a short question and answer session.

ZERO WASTE 5 Compost Tag

Location: The Garden **Time:** 30-40 minutes

Learning Objective

Students will play a game that illustrates the cycle of life and the role of decomposers in the food web. Without decomposers such as bacteria, fungi, worms, ants, beetles, and mites, decomposition would stop and resources which sustain life would be depleted. A seemingly endless variety of decomposers all serve different functions in the decomposition process. Every compost pile has its own food web. In this activity, we will look at the role decomposers play in the cycle of life: life, death, de- cay, and re-birth.

Management Skills

This game can accommodate any number of participants. It can be a "walking" tag game if it is to be played in a confined area. Played outside.

Activity Description

- Background Information – follow up after already reading "Garbage Helps my Garden Grow" and discussing compost with kids.
- Review the life cycle and the role of decomposers in nature and in composting. Idea is that they come up with food waste is composted, becomes soil, then soil helps food grow again.
- Split the group in half - humans and food
- Line them up facing each other, set boundaries that they have to stay within
- 4. Have the kids run towards each other. The humans eat the food through tagging them. When members of the food group are eaten, they sit down and are "out."
- Switch sides, have humans be food and food be humans.
- Bring group back together and ask them how we could make game last longer. Idea is that they think of composting food because you've been talking about it. Younger grades will need prompting.
- Assign 2 -3 kids to be gardeners who go around and compost the food that has been tagged. Food calls out "gardener!" or "composter!" Helps kids get familiar with vocabulary and concept of composting.
- Switch sides again

Wrap Up

Come back together and talk about how composting food makes game last longer, what does it do in the garden or life?

ZERO WASTE 6 Dirt for Lunch

Location: The Garden **Time:** 30-40 minutes

Learning Objective

Students will track the food in their lunches back to the earth through writing and drawing.

Materials

- Students' lunches
- Journals
- Drawing paper
- Crayons or markers
- "Dirt Made My Lunch" song print out/ written on board (below)

Background Information

All of our food, including animal products and processed foods, originates from the earth. We can trace our food back to its original form, and from there back to the soil. This activity illustrates the importance of healthy soil. When we send our biodegradable materials to the landfill, we waste valuable nutrients that the soil needs to give new life. Through composting, we recycle our biodegradable materials and give them back to the soil. Compost feeds the billions of soil organisms that are essential in healthy soil. Healthy soil means healthy plants. Healthy plants mean healthy people and animals.

This activity may work best with students working in pairs or small groups to encourage discussion and cooperation. Prepare sample lunches ahead of time to ensure variety. Simplify or make more complicated according to grade.

Activity Description

- Inform students that no matter what they have packed for lunch, ultimately, they are eating food from dirt.
- With younger kids (K-2, maybe 3) sing Dirt Made my Lunch Song
- Challenge students to name a food in their lunch that did not come from dirt.
- Help students figure out the ingredients in different foods and, as a class, trace each food's origin back to the earth.
- Ask students to list everything they are having for lunch.
- Use a tuna fish sandwich for example:
  - Bread came from wheat grown in the dirt.
  - Pickles are preserved cucumbers grown in the dirt.
  - Lettuce was grown in the dirt.
  - Mayonnaise came from eggs, that came from chickens, that ate grains grown in the dirt.
  - Tuna living in the ocean eat smaller fish, that eat zooplankton, that eat phytoplankton, which needs nutrients from the decomposed bodies of dead plants and animals that accumulate on the ocean floor and are brought to the surface by currents.
- Once students have made a list of ingredients, ask the students to draw pictures of where their lunches came from. For example, one drawing may have a field
- of wheat, a cow, a chicken, a farm, etc.
- Encourage students to show their drawings to the class and explain how their lunch came from dirt.

Wrap Up

Have students record in their journal what they eat in one day or one week, and do the same exercise.

Source: Composting Across the Curriculum, Marin County Department of Solid Waste