

LEARNING FROM TERRARIUMS

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Literature Review

The basic outlines for both the Teacher's and Student Guides were taken from the Teacher and Student Guides to Environmental Education Activities, K-6, developed by the Marian College Outdoor Ecological Laboratory. Also of help was the paper entitled "A Woodland Hike", by Donald VanMeter. Commercial terrarium mixtures were compared and similarities were found which provided the information on which these terrariums were based.

Procedure

A sample student guide was made and carried out. This provided information on how the instructions should be altered to produce a better learning experience. The basic guide for the amounts of charcoal, gravel, and topsoil to be added worked well. The amount of salt was increased from one tablespoon to two tablespoons, to speed up the reactions. Also, the amount of aerosol was changed from one three-second spraying, to two three-second sprayings, with one week in between them. The length of time (two weeks) was found to be sufficient for the various effects to be seen. Questions were added, along with observations to be made with suggestions about things to look for when making them. A teacher's guide was made from the adjusted student guide, with the addition of the necessary background material.

Teacher's Guide

Introduction

On Earth, man lives in a closed system. His air, water, and food are being continually recycled around and through him. Anything which is put into this system stays in the system. That is what is meant by a closed system.

A terrarium is similar to man's closed system. Whatever we include in the jar will stay in it until we remove the lid to let it out. Realizing this, we can change the environment inside the jar and draw similarities between what happens in the jar and what could and does occur in man's system.

Objective

When more is understood about the inter-relationships between the things in nature, more insight is gained about how man is an integral part of nature. This insight will become even more important in the future.

Behavioral Objective

To help develop in young, impressionable children a respect for nature, and an awareness that what man does to nature can have an unhealthy effect on him by showing how what can happen in a terrarium's closed system is similar to what happens in man's closed system—Earth.

Procedure

As the students walk along paths through the woods, or walk through a nearby field, they can gather small amounts of mosses, ferns, seed plants, and tiny animals like worms and snails that they might want to include in their terrariums. Permission should be secured to gather the plants and animals. These organisms should only be removed from where there is a large amount growing, and care should be taken to include all the plant's roots. Small paper or plastic bags can be provided for

the collection of these organisms. If it is not possible to let the students collect their own organisms, a selection can be provided for them.

Constructing Terrariums

Place from 1/2 to 3/4 inch of sandy gravel in the bottom of each jar. Cover that with the same amount of fine to medium-sized charcoal. (Charcoal briquettes may be used if they are pounded into very small pieces) Spread the same amount of topsoil on the charcoal, making sure it is free from rocks and large organic matter. This soil should be slightly damp, so wet it if necessary. On top of the soil place the collected plants and animals, dividing them as equally as possible among the jars. Dig a small hole in the soil for the roots of some of the ferns and seed plants. Mosses can be placed directly on the soil. Only one or two animals can be placed in each terrarium due to the size, so make sure any extra animals are released.

The students should select one of the jars and let it be the control. This will be put in the sunniest place in the room. The other terrariums will be compared to this one for any changes that may occur. This jar corresponds with man and his natural environment.

Another one of the jars will be placed in the closet so that no light can reach it. This will reflect what would happen to nature without the sunlight. Green plants need sunlight to produce energy from some of the other elements of nature: carbon, hydrogen, and oxygen; plus water and minerals. Without the sunlight, the chlorophyll (green, food-producing substance) in plants can't function, so the plants would die. Without plants, animals that eat plants (herbivores) would die. Without the herbivores, animals that eat other animals (carnivores) would die. This possibility that we might lose all the sunlight is rather remote, except in connection with air pollution, but the concept is useful

in showing the interdependence of living and non-living things.

In another jar, sprinkle 2 tablespoons of salt over all the plants and soil. This corresponds to the overuse of fertilizers and pesticides, and will show that when the soil is harmed, the plants and animals found on it are also harmed. Up to a certain point (saturation) the use of fertilizers and pesticides does not hurt the soil. When this point is reached, any further addition of the fertilizer or pesticide will cause an increase in the "salt" concentration of the soil. This changes the osmotic pressure between the roots and soil, making it difficult, and later impossible for the plants to absorb the necessary elements, water and minerals from the soil. The plants quickly dehydrate from lack of water and die. Other things happen when pesticides and fertilizers are overused: when it rains, part of the salt concentration is washed down through the soil into the ground water system; or, part of the salt concentration is washed off the fields and into the surface water system.

In the last jar, the students should spray the aerosol (deodorant, hair spray, etc.) for at least 3 seconds to saturate the air. When one week has passed, remove the seal and repeat the procedure. This will resemble the effects of air pollution on the environment. Air pollution increases the amount of harmful substances and tiny particles in the air. This can either cause an increase in the temperature between the pollution and the surface, or cause a decrease in the temperature depending on the size and quantity of the particles, and whether the particles reflect radiation away from or back toward the surface. Pollution can also reduce the effectiveness of the chlorophyll in the leaves of green plants by blocking the rays of sunlight needed for energy production. A slight increase or decrease in temperature by itself is not greatly harmful, but when occurring over a long time, the plants may have to adapt to

this change. Coupled with the interference in the energy production, the plants may die. If a thermometer is available, put a small hole in the sealing wrap and insert the thermometer making sure not to obscure the numbers. The opening should be resealed with a rubber band. The thermometer can be slid in and out if necessary to read it.

When everything has been added to all the jars, place an airtight cover on the mouths, either with the lid, or with plastic wrap and a rubber band. The jars with the salt and aerosol can be placed near the control.

Have the students look at the terrariums right after they are completed and write down what is observed. Observations should be made and written down every third day for two weeks, or longer if interest warrants. When they observe, remind them to look for signs of brownness around plant edges, sluggishness in animals, condensation in the jar sprayed with aerosol, discoloration in seed plants, etc. When they observe the plant in the closet, make sure they do it as quickly and with as little light as possible.

While they make the terrariums and when they are making observations, the similarities between the terrarium's closed system and man's closed system with nature should be stressed. The background information can be given when questions are asked about pollution, or when they show an interest in knowing more. The relationships and interdependence of all living and non-living things should be continually stressed.

The questions included in the Student Guide may be used as a basis for your own questioning, or can be used by themselves. These questions could be answered at the end of the first week, or anytime later.

Student Guide

In this exercise, you will be helping to make 4 terrariums. As your teacher takes you through a wooded area or through a nearby field, you will see many things that can be included in a terrarium. Collect some of these organisms, making sure that what you remove is not the only one present. Mosses, ferns, small plants like violets or even dandelions, and tiny animals like snails and earthworms are particularly well-suited for your terrariums. If you do not go out to collect your own organisms and a selection has been provided, choose a good variety of those organisms. Divide them into equal parts for four terrariums for each group.

Make your terrariums by putting in equal parts (1/2 to 3/4 inch) of sand or gravel, finely ground charcoal, and topsoil that doesn't have any big pieces of organic matter or rocks in it. Make sure the soil is damp by adding a little water to it. Put the plants and animals in the terrariums, making little holes for the roots of the plants. One of these terrariums will be left like this and placed in a sunny place in the classroom. One will be put in a closet or another very dark place. One will have 2 tablespoons of salt sprinkled over its plants and soil. The last one will have an aerosol (deodorant, hair spray, etc.) sprayed in it for 3 seconds now and again in one week. These last two terrariums can be placed near the first one in the sun. Make sure there are airtight covers on the jars, by using the lids, or if they aren't available, use plastic wrap and rubber bands.

Make observations on each of the terrariums right after they've been sealed and every third day for two weeks. Look at the one in the closet quickly so that it is exposed to as little light as possible. Check for signs of browning, discoloration, and wilting in the plants.

Watch the animals' behavior. Look for any water droplets on the inside of the terrarium sprayed with the aerosol. If your instructor has a thermometer, follow his/her directions, and be sure to read it when you make your other observations.

Answer these questions at the end of two weeks.....

	Terrarium 1	Terrarium 2	Terrarium 3	Terrarium 4
What happens to the plants?				
What happens to the animals?				
What is affected first-plants, or animals?				
Appearance of the plants, now and at the start.				
Appearance of the animals, now and at the start.				

If this happened on Earth, would man be affected: Terrarium 1 _____ How? _____
 Terrarium 2 _____ How? _____
 Terrarium 3 _____ How? _____ Terrarium 4 _____ How? _____

What can be done to stop or lessen the effects of:
 Overuse of pesticides? _____

Overuse of fertilizers? _____

Air pollution? _____

Closing Comments

These guides aren't restricted to any grade level. With slight changes or additions, they would be useful at any grade level a teacher chose to use them. Although they deal for the most part with pollution, their usefulness goes beyond that. Simply having the students make their own terrariums and emphasizing the similarities between the "world" inside the terrarium, and their own world shows them how they are an integral part of nature. Through activities like this, students learn more about their environment and how their decisions may affect it. This is all part of developing, as the introduction to the Marian College publication says, "an 'environmental ethic', which will come into focus when decisions affecting man's environment need to be made".