

Ecosystem in a Bottle – Educator Resource

Ecosystems – or biological networks – are all around us. Everywhere we go we are surrounded by living organisms attempting to live in harmony in their surrounding environments. In agriculture, each ecosystem provides the soil, water, light and warmth a seed needs to germinate and thrive. This activity allows you and your young scientists to explore the effects – positive and negative – they can have on their environment.

This project plan includes critical thinking questions to stimulate observations in not only the Ecosystem in a Bottle experiment, but also the ecosystems that make up our lives every day.

Overall Concepts

This experiment is a wonderful demonstration on how each part of an environment relies on one another to coexist and benefit. As you go on this journey with your scientists, encourage them to think critically about their own ecosystems. What are the components of home or school that work together to be successful?

- What are the roles of each of your family members/classmates that make the household/classroom successful? How does each person contribute to the class/home or help other family members/classmates? How does this change if one person is traveling or unable to do their part?
- The plant ecosystem is very similar to the classroom ecosystem. The clear bottle provides shelter for the plant while allowing light and warmth to enter the environment. The wicks draw the moisture into the soil which is then absorbed by the plants – not unlike an infrastructure that delivers the goods we need each day to our neighborhoods.
- Before you begin building the ecosystem, ask your scientists to outline what they want to include in their ecosystem. There is no need to limit the ecosystem to the materials in the kit.
- An earthworm or some dandelion seeds can make for a dynamic ecosystem and can spark critical thinking about the needs and wants for each organism introduced.
- Encourage your scientists to write down their hypothesis. This allows them to explain their plan and expectations of the outcome that they are trying to achieve in their ecosystem. *How do you expect the plants to grow? How much water will be absorbed from the reservoir? What will the plants look like or taste like? If they included many elements in their ecosystem, what do they expect to happen? How do they feel when there are lots of people in a crowded room?*

- During the experiment, encourage safety.
 - Hands should be washed before and after each experiment.
 - When reading over the directions, identify the materials you need. Make sure they are in good working order and the area you are working in is clear and clean.
 - Identify any steps your scientists may not be familiar with and take time to practice until they are comfortable with each step and tool.
- Encourage your scientists to make observations in their journals. Scientists do this everyday and it's great to get them in the habit early. This will allow them to replicate their projects and make comparisons from one ecosystem to another. Have them identify the expectations in their hypothesis of how each component they have added to their project should react and have them make notes on whether it met their expectations.

Step-by-Step

You can follow along with Val as she completes this experiment and explains more about ecosystems:

<https://vimeo.com/MonsantoSTEM/EcosystemInABottle>

We've set this video as accessible by link or embedding. We welcome you to embed this video onto social media or district page so others can enjoy this experiment, as well. It is also available for download so that you can upload it to your own channels if you wish.

Conversations Starters and Tips

Here are some ideas for creating dialogue with your scientists to encourage them to think critically about their ecosystems.

Step 1

Talk to your scientists about what they want to achieve in their ecosystem. Are they looking to create harmony or introduce challenges? How do they plant the materials to achieve their goals? Encourage them to capture these thoughts in their hypothesis and notes. If they confirm the hypothesis, they will want to know how they did it so they can replicate it, or use it as a control to introduce new variables in later experiments.

Step 2

Cutting the bottle can be difficult for some, so be encouraging to turn this into a teaching moment. What are the expectations of their bottle? Do they think the thickness of the plastic will give them the strength needed to support what was once a beverage and will soon to be a reservoir?

Step 3

In this step your scientists are creating the reservoir and the lid. What in the design makes the bottom of the bottle a good option for a reservoir? How much water can it hold? Will it stay steady on a counter or tip over?

Step 4

Why does the design use the top half of the bottle for the planter? There will be a small dish created that is not used in this experiment. What ways can they think of to reuse this dish rather than throw it away?

Step 5

The wicking material is used as a transportation method to get the water from the reservoir into the soil. Your neighborhood is an ecosystem; what are the methods used to deliver water to your environment?

Step 6

The water is kept separate from the soil. Why do you think that is? Why wouldn't you want all of the water in your ecosystem at the same time? What are the effects in your neighborhood ecosystem when there is too much rain or snow?

Step 7

The instructions tell you that the wicks should not be pressed against the side of the planter. Why do you think that note is there? What do you think would happen if the wicks are on the side rather than immersed in soil? What does the soil bring to the ecosystem?

Step 8

Seeds will add plant life to the ecosystem. There are three types of seeds included – basil, oregano, and thyme. What benefits do they offer the ecosystem? What challenges could they introduce? What recipes can you find that include these ingredients?

Step 9

In this step the scientists get to name their experiment. This is a wonderful opportunity to discuss how scientists work and the level of detail they capture in their observations, including naming their work for tracking purposes. Encourage them to be imaginative and pick a name that reflects their expectations of their ecosystem.

Step 10

The ecosystem is assembled! Now it's time to watch it grow and see how the elements mature. Have your scientists check their ecosystems each day to observe and record the progress in their journals. In a few weeks you will have fresh herbs to enjoy. Time to look back at step 8 and look at the recipes to see what tasty dishes you can make.

Continue to look for ecosystems and ask great questions on how the organisms work within each environment.

We would love to hear from you

Do you have other ideas on how to expand upon this experiment with your young scientists?

Please contact us at: stemeducation.outreach@monsanto.com

Feel free to share on your social channels.

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