

1.2: Decomposers Storyline Reading

Learning from the Work of a Ph.D. in Forest Ecology

Purpose for reading: As you read this text, work to make sense of the roles you will take on during this unit and how those roles relate to the work scientists do.

In earlier units, you worked with your classmates as questioners, investigators, and explainers to figure out how plants or animals use matter and energy. You then used that understanding to explain what happens in other plants or animals. Now, you will be taking on the roles of questioner, investigator, and explainer to figure out how decomposers use matter and energy to grow and function.

Scientists like me, Dr. Ellen Holste, move through these same roles to understand more about how the world works. I received my Ph.D. in Forest Ecology from Michigan State University. This is the story of how a natural disaster led me to become a questioner, investigator, and explainer as I studied mycorrhizal fungi, a type of decomposer.

My story starts when I was a Peace Corps volunteer in Guatemala. While I was there, a hurricane dumped a large amount of rain on the land in just a few days. I saw a pattern in the damage that this rain caused. In some places where there were forests, many of the roads and villages survived without too much damage. But in deforested areas, I saw how the hurricane caused landslides and the total destruction of villages. I wanted to find a way to help landowners improve their reforestation efforts. But I learned that re-growing forests was much more difficult than just planting trees. Young trees in Central America generally get plenty of sun and water, but they often grow poorly because they don't get enough soil nutrients. Most tropical soils are nutrient poor because the rain washes the nutrients away.

So I went to graduate school, where I learned about mycorrhizal fungi. These fungi can help trees grow by providing soil nutrients through their network of thread-like tubular structures (hyphae). At the same time, they obtain sugars to grow from their host plants. I wondered if I could use this organism to improve tropical reforestation efforts. In my work, I was a questioner, investigator, and explainer.

I was a questioner. Other scientists had found that there were two main types of mycorrhizal fungi associated with trees, one that enters into root cells of plants and one that mainly wraps their hyphae around plant roots. Building on work of other scientists, I asked questions such as: Is one fungal type better at taking up soil nutrients for its host tree than the other fungal type? Does this help the trees to grow better? During this unit, you'll be a questioner just like I was. You will develop good scientific questions through discussions with your peers and the Expressing Ideas and Questions Tool.

I was an investigator. I conducted investigations to answer my questions. I started from methods and results developed by other scientists. Previous investigations suggested that one



*Tropical reforestation using mycorrhizal fungi.
Photo Credit: Ellen Holste*



*Tropical trees grown with and without mycorrhizal fungi in a greenhouse.
Photo Credit: Ellen Holste*

fungus type may be better at taking up soil nutrients but at the price of higher sugar costs from their host plants.

I did my own investigations to understand the relationship between trees and their mycorrhizal fungi. I grew trees with each fungal type and without fungi. I fertilized my trees to provide different soil nutrient concentrations. I measured how much both the trees and fungi grew. After I completed my investigations, I had evidence that some trees grew better and had greater soil nutrient uptake with one of the two fungal types.

But my evidence prompted more questions than answers. I wondered why not all trees grew better with the mycorrhizal fungi. I wondered why the particular fungal type that was expected to be better at taking up soil nutrients actually was associated with the smallest trees. I also wondered why the initial size of the tree seed had such a big effect on how the trees interacted with mycorrhizal fungi. For example, the bigger the tree seed, the less of an effect the fungi had on tree growth.

Similarly, the evidence you collect will help answer some of your questions, but may lead to more questions or leave some unanswered questions.

During the unit, you'll be an investigator. You'll make predictions and then collect evidence to help answer the questions you asked earlier in the unit. Your methods will build on what you learned during the earlier units. It will be important to keep notes of your predictions, your methods, and the evidence you collect on the Predictions and Planning Tool, the investigation worksheets, and the Evidence-Based Arguments Tool. Your notes will help you to remember your ideas and evidence and to share them with your peers.

I was an explainer. As scientists answer their questions, they write reports to explain what happened and share their story with other scientists. Scientists do not always know all the answers, even after their investigations. I wrote my explanations in scientific papers and published them in scientific journals. I also wrote about my new questions. Other scientists read and critiqued my explanations and some scientists will conduct their own investigations to confirm, challenge, and build on my work. My research is just a small step in understanding mycorrhizal fungi's role in tropical reforestation efforts, but other scientists will continue to ask questions that will build on my and other scientists' ideas. These scientific questions may lead to more effective reforestation of tropical areas.

When you have enough evidence, you'll take on the role of explainer to put together the evidence and tell a scientific story. The Explanation Tools will help you figure out how to put the pieces together to tell a single story. Toward the end of the unit, you'll explain how a specific decomposer grows and then how other decomposers grow. Your peers will read and critique your explanations, providing feedback to help you improve your explanations.

At the end of the unit, you'll be able to answer some of your initial questions about how decomposers grow and function. While your answers will be based on evidence and tell a scientific story, there will still be more to investigate and understand. Likewise, you'll be able to apply what you learn about decomposers to other science units as you continue to ask scientific questions to deepen your understanding as well as the understanding of your peers about the world around you.