

## INVESTIGATION: Decomposition- It's a Dirt-y Job!

**CENTRAL QUESTION:** What role do fungi play in the cycling of matter in dry (xeric) and moist (mesic) environments?

**TIME:** 85-120 minutes

### OVERVIEW:

- **PART 1: Ready, Set, Rotten!** (20-30 minutes)  
How long does decomposition take?
- **PART 2: Hidden Soil Heroes** (45-60 minutes)  
Why is matter cycling faster in some ecosystems than others?
- **PART 3: Human Help or Harm?** (20-30 minutes)  
How do human activities affect decomposition and matter cycling?

### MATERIALS:

- One device (laptop or Chromebook) per student or pair of students.
- Whiteboard or other surface for the teacher to use while facilitating class discussions
- Additional resources:
  - Teacher Guide Measurement Tool (for use during Part 2: Hidden Soil Heroes)
  - Student Learning Assessment Tool
  - Student Rubric for Presenting Arguments
  - Student Rubric for Assessing Learning Outcomes

### STANDARDS ALIGNMENT:

#### NGSS Standard

- **MS-LS2-3 Ecosystems: Interactions, Energy, and Dynamics.** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

#### Utah SEEd Standard

- **Standard 6.4.3:** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. Emphasize food webs and the role of producers, consumers, and decomposers in various ecosystems. Examples could include Utah ecosystems such as mountains, Great Salt Lake, wetlands, or desert. (LS2.B)

#### Common Core State Standards (CCSS): English/Language Arts Standards

- **Speaking & Listening Standard 1:** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

- **Language Standard 6:** Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

## GETTING STARTED

Before class...

- Check permissions on students' devices to ensure they can visit <https://researchquest.org> and that they are able to download pdfs from that website.
- Login at [www.researchquest.org](http://www.researchquest.org) using the email address and password you used to create your Research Quest account.
  - Click "My Account" to access your *unique student access code* to share with your class.
    - *Note: Be sure to use the student URL <[www.researchquest.org/student](http://www.researchquest.org/student)> and access code for classes. This allows you to keep your administrative account free of student activity. Students should not create their own Research Quest account.*
- Review this lesson plan, making notes on standards and/or skills you would like to focus on with your students.
- Review the following recommended strategies for optimizing student learning outcomes.
  - During or after the investigation, you likely will want to pause for whole-class discussion to provide practice sharing and responding to peer ideas.
  - Build a shared vocabulary for the learning tasks. Identify target vocabulary words from the vocabulary lists in this guide and descriptions of student activities. Encourage students to use these words often. Model correct usage if needed.
  - Think about places where you can activate prior knowledge by prompting students to relate new concepts to a familiar context.
  - Think about how to integrate this EPIC investigation with other curriculum-aligned activities.
  - Create and engage student interest in the program by expressing your enthusiasm and/or describing your personal interest in studying museum specimens and learning more about entomology. You may also want to emphasize that students will be working with authentic materials on research questions that scientists actually address in their work. The scientist guide in this investigation is a real scientist studying museum specimens – not an actor!
  - Introduce students to sentence stems that reinforce flexible thinking and help students verbalize their thought processes:
    - "I see..."
    - "I think..."
    - "I wonder..."

In class...

- Provide a brief overview of the lesson to the class.
- Introduce the objectives the class will be focusing on today.
- Teacher Login at: <https://researchquest.org> using the email address and password you used to create your Research Quest account. Then, navigate to the Investigations.
- Students Login at: [www.researchquest.org/student](http://www.researchquest.org/student) using the Student Access Code unique to your account.
  - Locate and launch this investigation ("Decomposition: It's a Dirt-y Job")
- Once logged in, students will be on the landing page for this investigation.

## Part 1: Ready, Set, Rotten!

How long does decomposition take?

*(20-30 minutes)*

### OVERVIEW:

Students make predictions about how long three objects (an apple, a stick, and a ground squirrel) will take to decompose in xeric (dry) and mesic (moist) environments. They will learn points based on how close their prediction is to the actual minimum length of time. After earning a badge based on their point level, students reason about differences between decomposition times in these environments and make predictions about what environmental factors may impact those differences.

### VOCABULARY TO SUPPORT:

decomposition, matter cycle, ecosystems, xeric, mesic, disintegrated, minimum decomposition time, producers, consumers, decomposers

### BIG IDEAS TO SUPPORT:

- Decomposition happens faster in mesic (moist) environments than in xeric (dry) environments.
- Different objects decompose at different rates, even in the same environment.

### ASSESSMENT

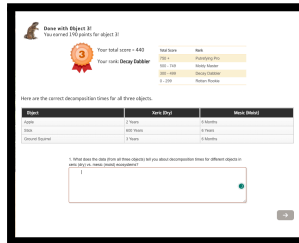
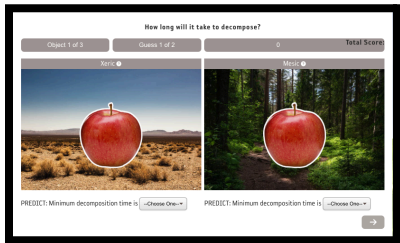
In this section, the instructor may find it useful to focus on the following critical thinking skills, defined in more detail in the [Student Learning Assessment Tool](#) located under the “Teacher Support” tab of the website:

- **Observations:** Encourage students to make observations about how long each object takes to decompose.
- **Comparisons:** Prompt students to make comparisons between the different lengths of time it takes for different objects to decompose.
- **Connections:** Students may be able to make connections between the mesic and xeric environments, the environment in which they live, and their own experiences with decomposition.
- **Flexible thinking:** Encourage students to share their thinking while also remaining open to why some environments may support different speeds of decomposition and why some objects decompose faster than others.

## LEARN-BY-DOING

### 1. PLAY & REFLECT

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**WHAT STUDENTS ARE DOING**

Students make predictions about the minimum amount of time it will take for three objects (an apple, a stick, and a ground squirrel) to decompose in a xeric (dry) environment and a mesic (moist) environment.

At the end of the game, students will answer four reflection questions that guide their reasoning about the differences between the speed of decomposition in xeric (dry) versus mesic (moist) ecosystems.



**TIPS FOR TEACHERS**

**Don't be afraid of productive struggle!** The game is designed to require learn-by-doing and iterative strategy refinement. Students may not answer correctly but they can still learn from their results and share what they are learning with each other.

**Is someone stuck?** Encourage other students to help anyone who is stuck in a game round. Listen to the strategies they discuss as fodder for post-activity discussion!

**Learn-by-Doing:** Do not instruct students on differences in the time it takes for decomposition to happen. Let them dive right in and discover these ideas via experiential learning!

**By the end of this section,** students will see that there are differences in the amount of time it takes things to decompose in xeric (dry) versus mesic (moist) environments, but they don't need to know why. They will have the chance to explore this phenomenon in more depth in parts 2 and 3.

**Strategies for support:**

You may find it helpful to guide students' reasoning toward the answers listed below as you monitor their conversations. Alternatively, use these questions with a full-class discussion to wrap up this section.

**Wrapping it up:**

Facilitate a brief class conversation to reinforce the big ideas of this section and help students discover that xeric environments tend to support less life than mesic environments.

Potential questions to ask:

- What are the characteristics of a xeric environment?
  - What animals live there?
  - What plants grow there?
  - What is the weather like?
  - What would the soil look like?
- What are the characteristics of a mesic environment?
  - What animals live there?

- What plants grow there?
- What is the weather like?
- What would the soil look like?

**Take it further:**

Students can design their own experiment to test how different factors (e.g., water, temperature) affect decomposition rates.

- They can create a mesic environment by adding moist soil and spraying water regularly to make sure it stays moist like a forest or riparian zone.
- To create a xeric environment, they might add dry soil, sands, and/or rocks to a container, simulating dry grasslands or desert conditions.
- In each environment, students can place organic objects and watch to see how long they take to decompose. Variations of this could include adding decomposers like earthworms and insects and tracking temperature and sunlight exposure.

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***This is the end of Part 1. Students may finish for the day or proceed to Part 2.***

## Part 2: Hidden Soil Heroes

### **Why is matter cycling faster in some ecosystems than others?**

*(45-60 minutes)*

**OVERVIEW:**

In this section, students generate their own data by sorting microscopic fungal remains from xeric and mesic ecosystems into categories. Analyzing these categories allows students to learn more about the role of fungi as decomposers in ecosystems and how fungi affect the rate of matter cycling in those systems. Students can also explore the differences in richness and abundance of fungal remains in wild (i.e. areas with low human interference) and urban (i.e., areas with high human interference) ecosystems by completing data collection for both urban and wild ecosystems or intentionally sharing their results with students who collected data from the ecosystem they did not study.

**VOCABULARY TO SUPPORT:**

matter cycling, soil, nutrients, fungi, ecosystems, xeric (dry) environments, mesic (moist) environments, decay, microscopic, fungal micro-remains (microscopic fungi), producers, consumers, decomposers, fungi abundance (# of fungi in the soil), fungi richness (how many different types of fungi are in the soil)

**BIG IDEAS TO SUPPORT:**

- Matter cycling and energy flow could not happen without decomposition.
- Microscopic fungi in the soil play an important role in breaking down matter into molecules, minerals, and nutrients that sustain life on Earth.
- Mesic ecosystems are home to more plants and animals, meaning there is more dead matter to break down and more fungi to break things down.

- Xeric ecosystems are home to fewer plants and animals, meaning there is less dead matter to break down and less fungi to break things down.
- Rates of matter cycling (i.e., how fast organic matter decomposes) are predicted by fungi abundance and richness.

### ASSESSMENT:

In this section, the instructor may find it useful to focus on the following critical thinking skills, defined in more detail in the [Student Learning Assessment Tool](#) located under the “Teacher Support” tab of the website:

- **Observations:** Students will make observations about fungi shapes in order to sort them into categories.
- **Interpretations:** Support student inferences about why mesic environments would have more plants and animals than xeric environments, and why xeric environments would have fewer plants and animals. More complex interpretations in this section might include making inferences about why there are more specialist fungi in mesic environments and more generalist fungi in xeric environments. Students will also be asked to interpret bar graphs to determine the abundance and richness of fungal micro-remains in xeric and mesic ecosystems.
- **Connections:** Encourage students to make connections between what they are learning about decomposition in mesic and xeric ecosystems and other related topics. For example, you could ask them about what organisms need to survive to draw attention to why mesic environments support more life.
- **Comparisons:** This section provides opportunities for students to make comparisons between fungal richness and abundance in wild (i.e., places with less human intervention) and urban (i.e., places with more human intervention) ecosystems.

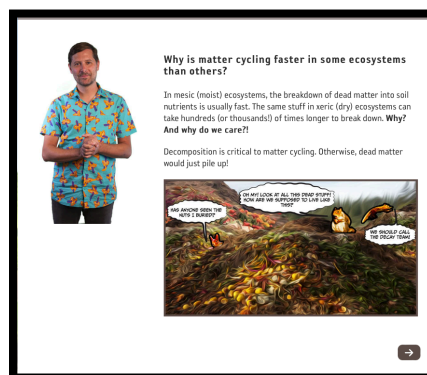
## INTRODUCTION

### 1. GATHER BACKGROUND INFORMATION



#### WHAT STUDENTS ARE DOING

Read a comic to learn more about the role of fungi as decomposers and what impacts the speed of decompositions.



#### TIPS FOR TEACHERS

Students read four pages of a comic about decomposition and learn that the speed of matter and energy cycling can be predicted by the abundance and richness of fungi in the soil.

#### Strategies for support:

These comics are designed to communicate visually as well as through text. However, consider utilizing reading

comprehension strategies to better support students' comprehension of the background ideas in the text. Some potential strategies to draw from include:

- Ask questions that check understanding and keep students focused on the big ideas.
- Help students make connections between what they are reading and their prior knowledge of related topics.
- Prompt students to ask questions they have about the text as they read.
- Ask students to summarize and ask clarifying questions during and after they read.

## 2. LEARN HOW



### WHAT STUDENTS ARE DOING

Students learn about how scientists calculate the abundance and richness of fungi in soil by matching up the image with the correct description.

**Analyzing fungal micro-remains.**  
We determine the abundance and richness of microscopic fungi in soil samples by counting and categorizing microscopic fungi. We call these microscopic fungi "fungal micro-remains."  
I love working in the lab! Try to figure out the process I use to find fungal micro-remains in soil. Drag each picture below into the correct step of the preparation process.

**Step 1:** Collect surface soil sample from field.

**Step 2:** In the lab, spin sample in liquid so it breaks apart.

**Step 3:** Filter liquid to remove large particles.

**Step 4:** Place a few drops of filtered liquid onto a glass microscope slide.

**Is someone stuck?** Images only stay in place when they are in the correct location. If an image isn't sticking, prompt students to try adding it to a different box.

Next, students learn two steps to categorize microscopic fungi based on their structure and shape.

- First, they determine whether it is a single cell or cluster of cells.
- Second, they identify whether the shape is rounded, pointed, or elongated.

Under the microscope, I take pictures of all the fungal micro-remains that I find. Then, I categorize species based on their structure and shape. This is a two-step process.

**Step 1 is to decide on the structure - Is it a single cell or a cluster of cells?** Use the guides below to learn how to identify the structure of fungal micro-remains.

**Single Cell**

**Cell Cluster**

**Step 2 is to identify the shape of the fungal micro-remains as one of three basic shapes: rounded, pointed, or elongated.** Use the guides below to learn to identify each shape. For warning: I'm going to challenge you to categorize micro-remains on your own very soon!

**Rounded**

**Pointed**

**Elongated**

**Is someone stuck?** The "next" button will not activate until students have viewed all guide pages (i.e., they need to select "Single cell" and "Cell Cluster" buttons before the next button will activate).



### TIPS FOR TEACHERS

The purpose of this activity is for students to learn more about how scientists calculate the abundance and richness of fungi in soil. Next, students will count and categorize microscopic fungi (i.e., fungal micro-remains) to categorize the abundance and richness of the soil where these fungi were collected.

INVESTIGATE

1. SELECT



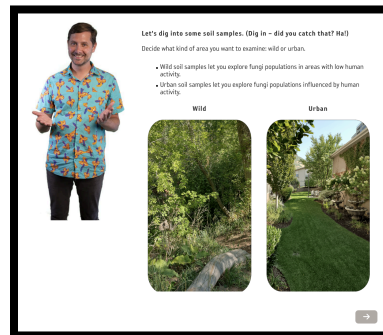
WHAT STUDENTS ARE DOING

Select which location you want to investigate.



TIPS FOR TEACHERS

Students select which location they want to study. They choose first from wild (i.e., low human interference) or urban (i.e., high human interference).

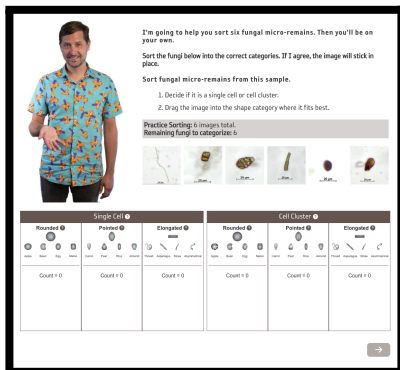


2. SORT



WHAT STUDENTS ARE DOING

Choose a sample location to start with then use the sorting tool to categorize fungal micro-remains collected from that site. You'll get one practice round where wrong answers don't stick, and then you'll be on your own!



**Is someone stuck?** Direct students to use the sorting guides (accessed by clicking on the “?” next to the chart labels) if they need to review the sorting guide. Prompt students to first identify whether they are looking at a single cell or cell cluster, then narrow down by shape.



**TIPS FOR TEACHERS**

**Strategies for support:**

After completing the practice, students can sort fungi into any boxes without receiving an error message. This means that students have the potential to generate very inaccurate data if they are not at least attempting to follow sorting guides to match the basic shape.

Note, this is an instance where there are no clear right or wrong answers; some of these fungal micro-remains are hard to sort and require a judgment call. Use this as an opportunity to facilitate a discussion about the importance of communicating and comparing your results with others. In this case, you can encourage students to share their data with their peers to see how their findings match their peers' findings.

**3. CALCULATE**



**WHAT STUDENTS ARE DOING**

Students analyze the data they generated by sorting fungal micro-remains and answer two reflection questions. Students have the opportunity to download a PDF of their responses.

Rates of matter cycling are predicted by fungi abundance and richness. Let's start with abundance. Abundance is indicated by the number of fungi in the soil sample!

- Low abundance = fewer than 20 fungi
- Moderate abundance = 20 to 40 fungi
- High abundance = more than 40 fungi

Count up the total number of fungi you categorized and categorize the abundance of each sample you analyzed.

My Wild sample had \_\_\_\_\_ abundance.

My Urban sample had \_\_\_\_\_ abundance.

	Single Cell	Cell Cluster
Wild	10	0
Urban	12	8

What do your results tell you about the speed of matter and nutrient cycling?

Remember: higher abundance and richness of fungi mean faster, more efficient matter cycling in the system below.

- Explain what your data tell you about the rate of matter cycling in your samples.
- What can you infer about matter cycling in wild (by) vs. more (less) locations in wild (urban)?

How does matter cycle...

Download PDF

**Great work! Making arguments using data is an important scientific practice!**

Fungal micro-remains in soil samples not only tell us about the speed of matter cycling, they also help us understand the overall health of the ecosystem.

Some human activities can disrupt or destroy fungi populations in our soil. That's a problem!

In the next activity, learn what humans can do to support their local fungi thrive in the soil, so they can break down matter. It's a dirty job, but we all rely on these hardworking little fungi!

Go To Part 3

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**TIPS FOR TEACHERS**

**Strategies for support::**

Help students make inferences about the rate of matter and energy cycling based on the abundance and richness of fungi found in the soil samples they analyzed.

We have created a teacher guide to data interpretation for teachers to use to guide their understanding of ideal data to be obtained from this activity. It can be found on the Support Materials page for this investigation.

**Take it further!**

This activity provides a good opportunity for students to share their data with each other and talk about any differences they found. Ask students to share their results in small groups or to the whole class, noting differences between results found in wild settings versus results found in urban settings. This will prepare students for the next activity, in Part 3, and give them opportunities to practice their speaking and listening skills.

***This is the end of Part 2. Students may finish for the day or proceed to Part 3.***

## Part 3: Human Help or Harm?

### **How do human activities affect decomposition and matter cycling?**

*(20-30 minutes)*

#### **OVERVIEW:**

In this section, students reason about how human activities can change fungi populations and reflect on what they can do in their neighborhood to protect their local fungi.

#### **VOCABULARY TO SUPPORT:**

organic matter, soil, nutrients, resources, producers, consumers, decomposers

#### **BIG IDEAS TO SUPPORT:**

- Decomposition helps keep matter and energy moving through ecosystems.
- Generally, darker-colored soil has more organic materials (including nutrients and other compounds essential for plant growth) than lighter-colored soil.
- Soil with more organic matter has higher fungi abundance and richness than soil with less organic matter.
- Human activity interferes with the natural balance of fungi in soil.

#### **ASSESSMENT:**

In this section, the instructor may find it useful to focus on the following critical thinking skills, defined in more detail in the [Student Learning Assessment Tool](#) located under the “Teacher Support” tab of the website:

- **Interpretations:** Students make inferences about the impact of human activities on fungi in soil.
- **Comparisons:** Students compare soil samples that have more and less human interference.
- **Connections:** Encourage students to make connections to the soil around the school, their homes, and communities.

## SOIL SORT

### 1. REVIEW



#### **WHAT STUDENTS ARE DOING**

Students will review the role of fungi in matter cycling and learn that soil color is associated with the amount of organic material (nutrients) it contains.

## 2. REVIEW



### WHAT STUDENTS ARE DOING

Sort the soil samples from dark to light, then add labels to show which side of the spectrum has high fungi abundance and richness, and which side has low fungi abundance and richness.

Comparing soil colors allows us to compare soil nutrients.

The Museum chart gets very detailed, but we can eyeball soil color to get a pretty good idea of its nutrient content.

The soil samples below are all from wild locations with low human activity. They dried out at the samples and taken some great photos for you.

**Instructions:** Drag and drop the images to order them by color, from darkest (far left) to lightest (far right).

Most Organic Material ←————→ Least Organic Material  
 Darkest Soil Color ————— Lightest Soil Color

Nice work! You are an excellent dirt-y scientist!

Let's correct this back to fungi. What do these soil colors tell us about fungi decomposers in the soil?

Drag and drop the fungi labels below onto the correct endpoints of the scale (the grey squares).

High fungi abundance and richness  
 Low fungi abundance and richness

Most Organic Material ←————→ Least Organic Material  
 Darkest Soil Color ————— Lightest Soil Color

This material is based upon work supported by the National Science Foundation under Grant # 1812844. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



**TIPS FOR TEACHERS**

Students drag soil images to the correct location on the soil spectrum, then drag labels indicating which side has high fungi abundance and richness and which side has low fungi abundance and richness.

**Strategies for support:**

The following prompts may help students reason about what soil color can tell them about the abundance and richness of fungi:

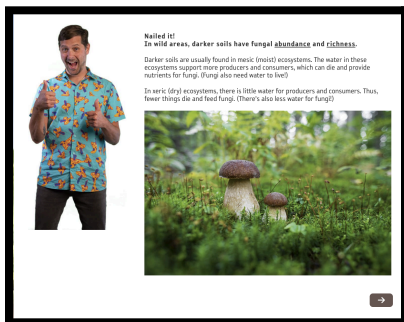
- How do fungi get energy? (*from nutrients/organic material in the soil*)
- How can you tell how much nutrients/organic material is in the soil? (*the color; darker soil has more, lighter soil has less*)
- Based on what we know about organisms needing food resources to survive, where would you expect to find more fungi abundance/higher numbers of fungi? (*darker soil because it has more organic material for fungi to eat*)
- Where would you expect to find more fungi richness/numbers of types of fungi? (*Darker soil because it has more organic material for fungi to eat.*)

**3. REVIEW**



**WHAT STUDENTS ARE DOING**

Students review why darker soil is associated with higher abundance and richness of fungi than lighter soil.



**Is someone stuck?** Direct students to use the sorting guides (accessed by clicking on the “?” next to the chart labels) if they need to review the sorting guide. Prompt students to first identify whether they are looking at a single cell or cell cluster, then narrow down by shape.

**TIPS FOR TEACHERS**

**Check for understanding of big ideas:**



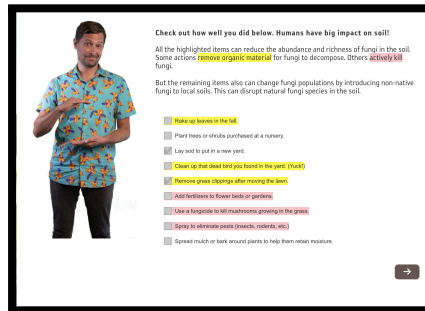
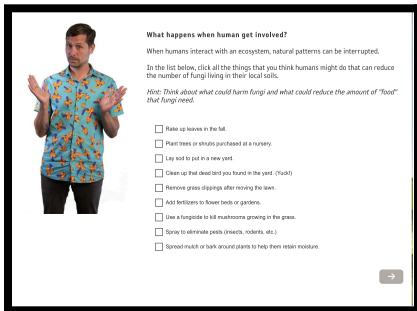
- In wild areas, darker soils have higher fungal abundance and richness.
- Darker soils are usually found in mesic areas, because there is more moisture which can support more producers and consumers, which leads to more organic matter broken down in the soil.
- Lighter soils are often found in places with less water, where it is harder to support life. This means there are less things that live in the environment and that get broken down into organic material in the soil.

### 3. REFLECT



#### WHAT STUDENTS ARE DOING

Reflect on what things humans might do that would reduce the number of fungi living in soils.



#### TIPS FOR TEACHERS

After submitting their response, they will receive feedback indicating that all the behaviors may change the number of fungi in the soil, but some remove organic material that fungi would need to eat, and others actively kill fungi.

For reference, these are their options and the associated impact on organic material in the soil:

- Rake up leaves in the fall. *(removes organic material)*
- Plant trees or shrubs purchased at a nursery. *(adds organic material)*
- Lay sod to put in a new yard. *(adds organic material)*
- Clean up that dead bird you found in the yard. *(removes organic material)*
- Remove grass clippings after mowing the lawn. *(removes organic material)*
- Add fertilizers to flower beds or gardens. *(may actively kill fungi)*
- Use a fungicide to kill mushrooms growing in the grass. *(actively kills fungi)*
- Spray to eliminate pests. *(may actively kill fungi)*
- Spread mulch or bark around plants to help them retain moisture. *(adds organic material)*

#### Strategies for support::

Prompt students to think about which things might remove fungi and which things might reduce the amount of “food” available for fungi.

## 4. REFLECT



### WHAT STUDENTS ARE DOING

Students use what they know about the impact of adding, removing, and killing fungi to reason about why a managed yard may have lighter soil than a natural yard.

Even in the same neighborhood, fungi in soils can differ based on human activity.

Take a look at the profiles below. Why might the natural yard have darker soil than the carefully managed yard?

Type your answer here.

Managed Yard	Natural Yard
<ul style="list-style-type: none"> <li>Weekly mowing (and clippings removed)</li> <li>Fungicide applied seasonally</li> <li>Pest control spray twice per year</li> <li>No pets allowed</li> <li>Dead leaves removed</li> </ul>	<ul style="list-style-type: none"> <li>Mowed monthly or less (clippings not removed)</li> <li>No fungicide applied</li> <li>No pest control spraying</li> <li>Pets allowed</li> <li>Dead leaves not removed</li> </ul>

### TIPS FOR TEACHERS

**For reference,** here are the facts provided about each yard to help students reason along with the implications of each of these actions for the amount of organic material in the soil:

- **Managed yard:**
  - Weekly mowing with clippings removed (*removes organic material*)
  - Fungicide applied seasonally (*kills fungi*)
  - Pest control spray twice per year (*kills fungi*)
  - No pets allowed (*missed opportunity for additional organic material through pet waste*)
  - Dead leaves removed (*removes organic material*)
- **Natural yard:**
  - Mowed monthly or less with clippings not removed (*adds/maintains organic material*)
  - No fungicide applied (*fungi are not killed*)
  - No pest control spraying (*fungi are not killed*)
  - Pets allowed (*organic material added through pet waste*)
  - Dead leaves not removed (*adds/maintains organic material*)



## 5. CHOOSE



### WHAT STUDENTS ARE DOING

Choose three things you and other people in your neighborhood can do to support your local fungi population and explain why that will support fungi.

**Support your local fungi!**

There are many things that you can do to support the fungi in your local ecosystems. Check out the list below and choose the **top three things** you think people in your neighborhood could do to support your local decomposition.

In my neighborhood, people can...

Type your answer here...

**Increase Organic Material**

- Leave grass clippings on lawn after mowing.
- Let fall leaves lie on ground through winter.
- Allow natural plants to grow and flourish undisturbed.
- What ideas do you have to increase organic material available for local fungi?

**Encourage Fungi Health**

- Leave mushrooms when they appear (do not remove).
- Limit use of fungicides and pesticides on lawns and in gardens.
- Avoid fertilizers with phosphorus (they damage fungi).
- What other ideas do you have to encourage fungi health?

Download →



### TIPS FOR TEACHERS

#### Assessment opportunity:

Consider gathering students' downloaded responses so that you look more closely at how students are using evidence to support their reasoning and use that understanding to help students expand their abilities.

***This is the end of Part 3 and of the investigation.***

***Check out one of our other Research Quest investigations on our website, <https://researchquest.org>***