

Focus: Decomposition and the Carbon Cycle

Grade Level: 7

Session Length: 45-60 minutes

Driving Questions

- What are our Project Crystal Code research questions?
- What happens during the process of decomposition?

NGSS Links

- Constructing explanations
- Obtaining, Evaluating & Communicating Information
- Engaging in argument from evidence

Systems Thinking Characteristics

- Identifying System Components & Processes

In the second session of Project Crystal Code, students are introduced to the mulch experiment, learn about the process of decomposition, and compare woody mulch and straw-like mulch.

First, students meet Kendra Walters, a doctoral student at the University of California, Irvine, who introduces them to this year's research questions. Next, students watch a timelapse video of a watermelon decomposing, and think about the role that decomposition plays in our mulch experiment. Finally, they will compare the two types of mulch we are investigating, woody mulch and straw-like mulch, to make some initial predictions about which one will decompose the fastest.

Learning Outcomes & Assessments

<i>By the end of this module, students will be able to...</i>	<i>You can assess this using...</i>
1. Describe the Project Crystal Code research project.	Whole class discussion; Field notebooks
2. Share three reasons why gardeners or land managers might use mulch.	Field notebooks
3. Describe the process of decomposition, and the role decomposition plays in a healthy ecosystem.	Field notebooks; Research team discussion
3. Compare and contrast woody mulch and straw-like mulch.	Field notebooks; Research team discussion

Session Overview

Section	Description	Length	Format
Launch	Students meet Kendra Walters, a graduate student from UC Irvine, and are introduced to our Project Crystal Code research questions.	10 minutes	Whole class
Explore	Students watch a timelapse video of a watermelon decomposing. After, they apply what they know about decomposition and the carbon cycle to explain what happened.	10-15 minutes	Research teams or individual
	Afterwards, students split up into their research teams to compare the two types of mulch through a series of pictures and videos.	10 minutes	Research teams
	Optionally, you may have students explore additional readings and videos that give background on the carbon cycle and decomposition.	15-25 minutes	Individual
Share	Students discuss their observations of the two mulch types with their research teammates.	10-15 minutes	Research teams
Reflect	In their field notebook, students reflect on what they've learned and why it is important to study decomposition.	5-10 minutes	Individual

Virtual Materials

- Session 2 Google Slides Presentation: <http://bit.ly/39fMmUg>
- Mulch Comparison Voicethread: <http://bit.ly/2M4UvIB>
- Session 2 Field Notebook Template (optional): <http://bit.ly/3sRhGRf>
- Optional decomposition reading: <https://bit.ly/2NCEGDI>
- Optional carbon cycle videos:
 - The Dirt on Decomposers: <https://youtu.be/uB61rfeeAsM>
 - The Carbon Cycle: <https://youtu.be/hgFpvDNfXOk>

Each student will need...

- A device with internet access (a computer, smartphone, or tablet will all work!)
- Field notebook and pencil

Before You Start Teaching

- Decide how much background information your students may need about the process of decomposition. Additional resources for students are included in the Google Slides presentation on [Slide 14](#), but you may want to ask them to read the short article or watch the videos before beginning the session, especially if students haven't recently learned about the carbon cycle.
- Copy over the [Session 2 Slideshow](#) to your own Google Drive account. Test to make sure that the videos work. (If not, you may have to check the permissions on the Crystal Cove Conservancy Youtube Account.)
- Decide the best way to share the link to the mulch comparison Voicethread slideshow with each research team.

Learning Sequence

Launch

Before Beginning: Carbon Cycle Review (15-25 minutes)

1. If you have not reviewed the carbon cycle with students this school year, consider whether you want to assign any background reading or videos as independent student work before beginning Session 2. You can also integrate a short review into the middle of the session.

What is Our Project Crystal Code Experiment? (10 minutes)

1. Open the [Session 2 Slideshow](#) and play the video on [Slide 2](#) for your class. In this video, Khai will briefly introduce Session 2. After watching the video, move on to Slide 3, which gives an overview of what students will do and learn during Session 2.
2. Play the video on [Slide 4](#). Students will again meet Kendra Walters, the UC Irvine graduate student studying decomposition that they'll be working with this year. Kendra introduces her research and the project that students will be helping.
3. Continue to [Slide 5](#) to hear Khai explain how we came up with our research project, and ask students to consider why mulch would be used when trying to grow plants.
4. Advance to [Slide 6](#), and give the students a moment to reflect and write down a few reasons why gardeners or land managers might use mulch in their field notebooks. If you have time, ask students to share their initial ideas out loud.
5. Once students have had a few minutes to think, move on to [Slide 7](#) to hear Khai explain why we are interested in testing the effectiveness of mulch, and introduce this year's 3 research questions about the impact of mulch.

After, advance to [Slide 8](#) and review our three research questions with students. These are the questions that we'll be trying to answer during Project Crystal Code.

- **Research Question (1): Mulch decomposition rate.** Which type of mulch will decompose the quickest and which will decompose the slowest: woody mulch or straw-like mulch?
- **Research Question (2): Mulch effect on decomposition.** Where will mulch decompose the quickest and where will it decompose the slowest: in areas with woody mulch, or straw-like mulch?
- **Research Question (3): Mulch effect on soil moisture.** Where will the soil moisture be highest and where will it be lowest: in areas with woody mulch, straw-like mulch, or no mulch?

Explore

Part 1: Thinking About Decomposition (10-15 minutes)

1. Move on to *Slide 9* and play the video, where Khai will tell students that before we dive into the project, we first want to think more about the process of decomposition.
2. Make sure students have their field notebooks ready to record notes, then advance to *Slide 10*. Ask students to record what they notice as they watch a watermelon decompose. As the video finishes, prompt students to record their predictions about what they think is happening.
3. Once the video is done, move on to *Slide 11* and play the video of Khai asking students to think about the process of decomposition, then move on to *Slide 12* and give students a moment to respond to the questions:
 1. Did you see any evidence of decomposers at work? If yes, describe what you observed.
 2. Draw a diagram showing what you think happened to the watermelon as it decomposed. Make sure to show what happened to the watermelon that we could not directly see, and label any parts of your drawing.
 3. When the dead organic material in the watermelon (such as carbon) broke down, where did it go? Did it disappear or was it converted into something else?
 4. How does the process of a watermelon decomposing connect to the larger system? Is the process of decomposition part of any other cycles in nature?
4. After students have had five minutes to think on their own, invite them to share their responses to the questions out loud. Encourage them to connect what they saw (the watermelon decomposing) to processes that they couldn't see, as the carbon of the watermelon was converted into decomposition. Make sure to elevate ideas related to how decomposition is one part of the larger carbon cycle.

5. Finally, move on to *Slide 13* to hear Khai explain the role of decomposition and the carbon cycle.

If you have not already shared additional background resources with students, videos and reading are listed on *Slide 14*. You can spend time watching and discussing them together, or skip over the resources if your time is limited and the topics are not new for your students.

Part 2: Investigating Our Mulch (10-15 minutes)

6. Tell students that next, they'll have a chance to start comparing the two types of mulch involved in our study to think about our first research question regarding which one will decompose more quickly.

Move on to *Slide 15* and play the video for students, which will introduce them to the next task, which is investigating the two types of mulch to think about how they might decompose differently.

7. After playing the video, advance to *Slide 16*. This slide includes instructions for students to set up their field notebooks, along with a link to a Voicethread slideshow with pictures and videos of the two mulch types.

8. Decide if you want students to work independently or in their research teams. Then share the link to the slideshow so they can make observations and record them in their field notebook.

Share

What Did You Observe? (10 minutes)

1. Once students have had time to move through the Voicethread and compare the two mulches, move to *Slide 17* with discussion questions for the research teams. Give the groups time to compare the two types of mulch in their teams.

If there's time, you can also ask groups to share their initial ideas about the mulch as a class.



Reflect

Reflecting on Session 2 (5-10 minutes)

1. Tell students that they have one last task. In the slideshow, advance to **Slide 18** and play the video, where Khai will invite them to spend a few minutes reflecting.
2. Move on to **Slide 19**, which will share reflection questions. Ask students to spend five minutes reflecting on their experiences today in their field notebook.
3. Finally, if you are able, thank the class for their time today. Tell them that when you gather again, they will start thinking about mulch's role within the broader ecosystem and its influence on decomposition as they build a model of the Moro Canyon ecosystem.