

Focus: Creating a System Model

Grade Level: 7

Session Length: 60 minutes

Driving Questions

- What abiotic factors, biotic factors, and processes affect decomposition and carbon cycling at The Bowl research site in Moro Canyon?
- How can we create a model that shows how water-saver plants, water-spender plants, and non-native plants affect decomposition rates in Moro Canyon?

NGSS Links

- Designing and Using Models
- Using Mathematics and Computational Thinking
- MS-LS2-3
- MS-LS2-4

Systems Thinking Characteristics

- Identifying System Components & Processes
- Identifying Simple Relationships Between System Components
- Organizing System Components & Processes within a Framework of Relationships
- Identifying Hidden Dimensions of the System

In the third session of Project Crystal Code, students work with their research teams to design a model that shows their initial ideas about how different components and processes within the ecosystem of Moro Canyon affect decomposition.

During the first half of the session, research teams brainstorm a list of biotic components, abiotic components, and processes that are involved in decomposition and the carbon cycle. During the second half of the session, the teams come back together to collaboratively design a model using an online platform to show how different plant types impact decomposition rates in Moro Canyon.

Learning Outcomes & Assessments

<i>By the end of this module, students will be able to...</i>	<i>You can assess this using...</i>
1. Generate a list of biotic components, abiotic components, and processes that are involved in decomposition and the carbon cycle in Moro Canyon.	Field notebooks
2. Create a model that shows how water-savers, water-spenders, and non-native plants impact the decomposition rates in Moro Canyon.	Research team models
3. Use their model to predict how changes in the environment will impact the decomposition rates in Moro Canyon.	Field notebooks; Research team models; Research team discussions
4. Reflect on why scientists use models to make predictions about real-world systems.	Whole class discussion; Field notebook reflections

Session Overview

Section	Description	Length	Format
Launch	Students watch a video that introduces them to the idea of creating a model.	5 minutes	Whole class
Explore	Research teams generate a list of components and processes involved in decomposition and the carbon cycle in Moro Canyon.	10 minutes	Research teams
	Research teams then work together to create a collaborative model using Padlet, SageModeler, or another online platform of the teacher's choice.	20 minutes	Research teams
	Optionally, research teams can also use their models to make predictions about how changes to the ecosystem will affect decomposition.	10 minutes	Research teams
Share	If there is time, students share their models with the whole class.	5-10 minutes	Whole class
Reflect	Students reflect on what they've learned from their model and what their next steps might be.	5 minutes	Individual

Choosing a Modeling Platform

In Session 3, student research teams work together to build a model that shows how different biotic components, abiotic components, and processes impact the decomposition rates in our Project Crystal Code experiment.

As the lead educator, you can choose which platform you want your class to use while building their model. Unfortunately, while online modeling platforms exist, no one platform is perfect. We recommend choosing between [Padlet](#) or [SageModeler](#), but you could also use Google Jamboard, another online whiteboard, or another platform entirely.

The pros and cons of our two recommended platforms are listed below.

Platform	Pros	Cons
<p>Padlet</p> <p>Cost: Free for first three boards; requires \$10/month subscription for additional boards</p>	<p>Modeling can be done collaboratively with multiple students using one online workspace at the same time.</p> <p>Teacher can see thinking in real time.</p> <p>Students can import videos, links, and images within the posts.</p>	<p>More difficult to show links and explain computational relationships.</p> <p>A free account can only create three Padlets (meaning students will need to sign up for their own account).</p> <p>Cannot import data and use it to test the assumptions in the model.</p>
<p>SageModeler</p> <p>Cost: Free</p>	<p>Specifically designed to support student modeling.</p> <p>Has a clear way to define computational relationships between components and processes.</p> <p>Can run simulations to see the effects of one component on another.</p> <p>Can import data to test the model and make graphs (which can be used to analyze data in Session 7).</p>	<p>One one person can manipulate the model at a time (meaning one student will need to manipulate the model and share their screen with others).</p> <p>Teacher can only view the contents when the link is shared, so it is hard to see thinking in real time.</p>

Virtual Materials

- Session 3 Google Slides Presentation:
 - *If you're using Padlet*
 - *If you're using SageModeler*
- *Session 3 Field Notebook template (optional)*
- Template for your chosen modeling platform:
 - *Padlet Template*
 - *SageModeler Template*

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 which platform you want students to use when building their research team model: Padlet, SageModeler, or another platform of your choice.
- Copy over the *Session 3 Slideshow* for your chosen platform 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 how you want students to collaborate and share their ideas as they are brainstorming a list of components and processes and reflecting on their models.

Learning Sequence

Launch

Getting Started with Modeling (5 minutes)

1. Open the [Session 3 Slideshow](#) and play the video on [Slide 2](#) for your class. In this video, Kaitlin will briefly introduce Session 3 and the fact that students will work in their research teams to build a model of the ecosystem at our Project Crystal Code research site in Moro Canyon.
2. Next, move on to [Slide 4](#), which gives an overview of what students will do and learn during Session 3.

Explore

Explore Part 1: Brainstorming Components & Processes (10-15 minutes)

1. Advance to [Slide 4](#) and play the video. Kaitlin will introduce students to the first task in creating their model: they will need to work in their research team to brainstorm a list of abiotic components, biotic components, and processes involved in decomposition and carbon cycling at The Bowl experiment in Moro Canyon.
2. Once the video is done, move on to [Slide 5](#) and reiterate the task for students: They will work in their research teams to brainstorm abiotic components, biotic components, and processes involved in decomposition and the carbon cycle in Moro Canyon.

Let students know how you want them to record their list (in a shared Google doc, in their field notebook, etc.).

Some tips to share with students:

- We want to think about anything in the ecosystem that is involved in decomposition and the carbon cycle.
- Try to sort the list into abiotic components (non-living things), biotic components (living things), and processes (things that can happen).
- For now, all ideas are good ones! Your research team will be able to decide which components and processes are most important later.
- It's okay to think categorically rather than worry about particulars (saying "herbivores" or "decomposers" instead of naming exact species found in Moro Canyon).

3. Break students into their research teams and give them 10 minutes to brainstorm their list. If possible, give them a two-minute reminder before the end of the brainstorming time.
4. When the research teams are done brainstorming, play the video on [Slide 6](#). In this video, Kaitlin will challenge students to pick the 10-12 items from their list that have the biggest effect on decomposition.
5. Move on to [Slide 7](#) and ask students to break back into their research teams. Give them two minutes to choose the 10-12 items on their shared list that they think will be most important to include in their team model.

If there is time, ask the research teams to share some of the final components and processes on their list with the whole class.

Explore Part 2: Building a Model (25-30 minutes)

6. Once students have finished drafting their list of components and processes, move on to [Slide 8](#) and play the video for the whole class. This will introduce them to the modeling platform that they will be using to build their team models.
 - If you are using Padlet, the model-building instructions are broken in two. There is one video on how to register for an account and set up a Padlet for their research team ([Slide 8](#)), written instructions on how to set up the Padlet ([Slide 9](#)), and a second video and written instructions on how to use Padlet to build a model ([Slide 10-11](#)).

Note that as students set up their model, they are asked to use conditional statements to describe the relationship between different components of the model. They will use these conditional statements to construct logical proofs later on so that they can use their model to make predictions about how changes to the ecosystem may impact the decomposition rates.

- If you are using SageModeler, there is one video on how to use SageModeler on [Slide 8](#) and a second with written instructions on [Slide 9](#).
7. Give students research teams 20 minutes to build their models. If it is possible, visit each group (whether virtually and in person) to check in on their progress. As you do so, encourage them to think about parts of the ecosystem and processes that they can't see, as well as those that are visible.

Explore Part 3: Using the Model to Simulate Change (Optional) (10-15 minutes)

8. If there is time, you can also ask student research teams to use their model to think about how changes to the ecosystem will impact decomposition rates.
- If you are using Padlet, the video on [Slide 12](#) introduces the idea of how to use student models to think about change. [Slide 13](#) has instructions for students to apply that thinking to make a prediction using their model.
 - If you are using SageModeler, students can use the slider bars within SageModeler to simulate change within their model. The screencast video on [Slide 10](#) and the instructions on [Slide 11](#) will introduce how to do this.
9. After introducing the task, give students five to ten minutes to explore their model and determine how changes to the ecosystem will impact decomposition rates.

Share

Sharing Our Models (Optional) (5-10 minutes)

1. If there is time, gather the entire class or research teams for a group discussion. Invite the research teams to share their models and discuss the questions on [Slide 12](#) (SageModeler) or [Slide 14](#) Padlet).

Reflect

Reflecting on Session 3 (5 minutes)

1. Tell students that they have one last task. In the slideshow, advance to Padlet [Slide 14](#) (SageModeler) or [Slide 16](#) (Padlet) and play the video, where Kaitlin will invite them to spend a few minutes reflecting.
2. Move on to the final slide, 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 use their models to come up with a hypothesis for our Project Crystal Code research questions.