

Session 4: Monitoring Butterfly Populations

Focus: Monitoring Projects and Habitat Restoration

Grade Level: 6-12

Session Length: 100-120 minutes
(Sessions can be done in class or assigned as homework)

Driving Questions

- Does data from a Crystal Cove State Park butterfly monitoring project indicate whether the number of butterflies and the diversity of butterfly species is increasing over time at The Bowl restoration site?

NGSS Links

- Analyzing and Interpreting Data
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

California Common Core State Standards Mathematics Links

- Statistics and Probability
- Interpreting Categorical and Quantitative Data
- Making Inferences and Justifying Conclusions

Computer Science Standards Links

- Data and Analysis

In this Environmental Challenge, students are introduced to a butterfly monitoring project at an area at Crystal Cove State Park that is being restored to a native habitat.

The plant community at “The Bowl” was degraded long ago by cattle and sheep grazing, and land managers are now trying to bring back the native plant community to the area. We want to know if the restoration process is affecting the butterfly population. If we monitor the number and diversity of butterflies at The Bowl before, during, and after the restoration process, it can help us figure out if the habitat restoration is working.

Crystal Cove State Park is home to around 30 different species of butterflies, and while they may seem like a small part of our ecosystem, they play a key role in helping understand the health of a habitat. In order to support a diverse population of butterflies, an area also must have a diverse number of plant species to support them. Because they often live their whole life cycle in one season, they are also one of the first clues we have to changes in our ecosystem.

In 2017, Crystal Cove Conservancy began monthly butterfly surveys to help us monitor the health of both our butterfly population, and the ecosystem as a whole. Each month, staff and volunteers hike along regular routes, recording the total number of butterflies and the number of different species along the way. One of our butterfly surveys passes by The Bowl that is currently being restored to a native habitat by Crystal Cove State Park. The plant community at The Bowl was degraded long ago by cattle and sheep grazing, and land managers are now trying to bring back the native plant community to the area.

During the environmental challenge, students will...

1. **Learn** about butterflies and habitat restoration at Crystal Cove State Park.
2. **Make** a computer model of the different factors in an ecosystem that affect butterfly populations using a modeling software named SageModeler.
3. **Develop** a hypothesis about whether butterfly diversity and abundance change over time.
4. **Virtually** collect data on butterflies at Crystal Cove State Park to gain a better understanding of data collection methods.
5. **Analyze** the data that have been collected at The Bowl by using SageModeler.
6. **Share** their findings about any trends they saw in the butterfly data with their classmates and Crystal Cove State Park.
7. **Reflect** on the experience of analyzing data.
8. **Connect** with STEM professionals and like-minded peers to explore STEM content and careers in more depth.

Session Overview

<i>By the end of this module, students will be able to...</i>	<i>You can assess this using...</i>
1. Value the environment and understand that it is under threat and should be protected from human impacts.	Student notebook page; class discussions
2. Describe butterflies and how field scientists count them to monitor changes in their populations.	Student notebook page
3. Develop a hypothesis for two monitoring questions.	Student notebook page
4. Use SageModeler to create a computer model and to analyze and visualize data sets.	Student notebook page; class discussions
5. Describe patterns and trends in ecological data and share their findings with Crystal Cove State Park.	Student notebook page; class discussions
6. Reflect on why they care about protecting butterfly populations and native habitats.	Student notebook page; class discussions
7. Participate in class discussions and discover shared areas of interest with classmates and explore those areas of interest together.	Class discussions
8. List other opportunities to engage with other interested students.	Student notebook reflection
9. Connect with STEM professionals during and/or after the environmental challenge to learn more about STEM disciplines and careers.	Questions posted to Padlet

Learning Outcomes and Assessments

<i>Section</i>	<i>Description</i>	<i>Length</i>	<i>Format</i>
Launch	Students learn about butterflies and the monitoring project at The Bowl through a slideshow and online resources. They develop two hypotheses about whether the abundance and diversity of the population is changing over time .	45-60 minutes	Individual or Whole class
Explore	Students virtually collect butterfly data and then analyze the raw data collected by staff and volunteers at The Bowl.	10 minutes for introductory video; 20-25 minutes for data analysis and visualization	Individual
Share	Students share their findings with Crystal Cove State Park through Google Forms and with their classmates through a class discussion.	15 minutes	Individual and Whole Class
Reflect	In their student notebook, students reflect on whether they think it is important to protect the butterflies and native habitat at Crystal Cove State Park. Students also reflect on their role in this project and how they contributed to Crystal Cove State Park’s efforts to protect the native habitat.	10 minutes	Individual and Whole Class

Virtual Materials

- *Online Environmental Challenge from Crystal Cove Conservancy's website*
- *Introduction to the Butterfly Monitoring Project*
- *Resources About Butterflies*
 - *Butterflies of Orange County*
 - *Why Butterflies Matter*
 - *What's Happening to the Monarch Butterfly Population*
 - *Orange County Butterfly Population*
- *Google forms for sharing a hypothesis*
- *Virtual Data Collection Video*
- *Using SageModeler to Make a Model Tutorial*
- *Data Uploaded to SageModeler*
- *SageModeler Model Link*
- *Data Analysis Crash Course YouTube Video*
- *Butterflies Question board*
- *Google form for sharing findings*
- *Reflection Video*
- *Student notebook pages*

Each student will need...

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

Before You Start Teaching

- Decide if you want your students to use the student notebook pages. This can be a good option if you want to collect student's work at the end of the project.
- Decide if you want to do the challenge during class time, assign it as homework, or a combination of both.
- This challenge can be done during class as a whole group or it can be assigned for students to work on independently in class or at home. The following instructions in the Learning Sequence describe how to lead students through the challenge as an in-class activity.
- Decide if you want students to work individually or in small groups

Learning Sequence

Launch

Getting Started (15-30 minutes)

1. Open the **Introductory Voicethread Slideshow** and play the video on Slide 2 for your class. In this video, students will meet Kaitlin, who will introduce you to the butterfly monitoring project and how it is connected to the coastal sage scrub habitat at The Bowl.
2. After you've finished the video, reiterate to students that your class has been asked to help protect the California gnatcatcher by analyzing data and sharing their findings with Crystal Cove State Park.
3. Continue to advance through the slideshow as a class or ask students to continue on their own.
 - A. **Slide 3** gives information about butterflies at Crystal Cove.
 - B. **Slide 4** describes the relationship between butterflies and native habitats.
 - C. **Slide 5** describes the butterfly monitoring project.
 - D. **Slide 6** the restoration project at The Bowl.
 - E. **Slide 7** describes how students can analyze data and help Crystal Cove State Park land managers by sharing their findings.
 - F. **Slide 8** includes links to additional resources about butterflies.
4. Next, students can learn more about butterflies by exploring the resources posted in **Step 1** on the website.
5. Next, students consider two monitoring questions in order to develop a hypothesis. Direct students to **Step 2** on the website to read the two monitoring questions:
 - A. **Monitoring Question (1):** Does butterfly diversity change over time at The Bowl restoration site?
 - B. **Monitoring Question (2):** Does the butterfly abundance change over time at The Bowl restoration site?
6. In order for students to make a prediction, it will be helpful for them to create a computer model in SageModeler. This **tutorial** will help them become familiar with SageModeler. Once they feel comfortable using SageModeler, they can create their own model at this **link**.

6. Ask students to predict what they will find when they analyze the butterfly data set and make a hypothesis for each monitoring question. Ask them to complete the [Google Form](#) on the website and write their hypotheses in their student notebook page.

Explore

*Virtually Collect Data and Analyze Raw Data
(7 minutes for introductory video, 20-25 minutes for data analysis and visualization)*

1. Show the students the video of butterfly data collection or ask them to watch it individually. During the video, students will learn about how Crystal Cove butterfly volunteers survey butterflies, and identify butterfly species from the route along The Bowl Restoration Site. After watching the video and recording any butterflies they can identify, they can submit their data using this [Google Form](#).
2. Ask students to [analyze the data](#) in SageModeler from Step 4 on the website and create data visualizations to answer the two monitoring questions.
3. If students need some assistance with analyzing and visualizing the data in SageModeler, ask them to watch the [Data Analysis Crash Course Slideshow](#) in [Step 4](#) on the website.
4. If students are working on this during class, circulate throughout the class to monitor the progress of students and assist them if necessary.
5. If students have questions about the data that need to be answered by a Crystal Cove Conservancy staff member or a scientist, collect questions and submit them as a class to the [Padlet Questions Board](#) or allow students to individually submit questions.

Share

Share Your Findings (15 minutes)

1. After the students have analyzed the data, they will share their findings with Crystal Cove State Park through the [Google Form](#) in [Step 5](#) on the website. If possible, facilitate a class discussion about their findings before students submit their information to Crystal Cove State Park.

A class discussion will give students an opportunity to explain their findings and make any necessary revisions based on new information that comes to light during the discussion. Encourage students to share the evidence from their data that supports their findings.

2. Remind students to include any data visualizations that they created in the Google Form. If you had students use the student notebook page, remind them to record their findings on the student notebook page and return it to you at the end of the project if you wish to see their work.
3. If students are interested in communicating with other students who have analyzed the data, they can submit thoughts, comments, and questions to the *Padlet*.

Reflect

Reflecting on Butterfly Monitoring (10 minutes)

1. Tell students that they have one last task. Remind them that it's important for scientists to take time to reflect on how our thinking is changing. Show the *video* on the website page of Kaitlin talking about reflection and about the butterfly monitoring project.
2. Ask students to spend five to ten minutes reflecting on their experiences by answering the following questions in their student notebook or in another document if you aren't using the student notebooks. If possible, facilitate a class discussion to allow students to share their thoughts with each other.
 - A. What did you do during this environmental challenge?
 - B. What did you learn? How did your thinking change?
 - C. Do you think it is important to protect native habitats at Crystal Cove State Park? Why or why not?
 - D. Did you enjoy analyzing data and sharing your findings to help protect the butterflies and native habitat? What did or didn't you like about the experience?
 - E. Would you like to learn more about butterflies, the coastal sage scrub ecosystem, or how scientists monitor populations there? If so, what topics interest you? Do you have ideas of how you could learn more about them?
3. If students are interested in exploring other community science activities or careers related to ornithology or environmental science, encourage them to explore the links to the following websites in *Step 6* on the Environmental Challenge website.
 - A. *Butterflies of Crystal Cove State Park*
 - B. *iNaturalist Project List*
 - C. *SciStarter Project Finder*
 - D. *Zooniverse*
 - E. *Interview with a Lepidopterist*
 - F. *Lepidopterist Job Description*
 - G. *environmentalscience.org*