

Week 10 Climate 101

Climate Changes Impact Ecosystems and Human Systems

Overview of the Week

- * Participants take the Post-Test. Results can inform instruction and participant grades.
- * Participants explore the Climate Change Impacts interactive. They learn about four major types of impacts and how these impacts can harm Pacific island ecosystems and human community systems. In addition, they explore different options for increasing ecosystem resilience and human system resilience.
- * Participants increase their understanding of ocean acidification by investigating how carbon gets dissolved into ocean water and increase the acidity of ocean water.

Before Teaching this Week:

- * Make sure computer lab can be available for the second session and that the computers there can run the PCEP Impacts of Climate Change interactive.
- * Have sufficient copies of the test.
- * For Day 2, make 4 copies for each participant of the first page of the climate change impacts Word document. The other pages of that document are just for the presenter. Also make one copy for each participant of the Impacts Handout pdf (color preferred) and the Sea Level Handout.
- * For Day 3, gather materials to enable participants to work in groups to investigate how carbon gets into water. Groups should have adequate materials to compare carbon dioxide getting into standing water (using plastic cup with lid) and storm-agitated water (using self-sealing plastic bag). See LHS Ocean Science Sequence Session 2.5 and this write-up. Also have some vinegar and ammonia to demonstrate the BTB color changes that they cause. You can also have optional materials and containers to demonstrate the effects of pH on carbonaceous shells and/or chalk.
- * Review the write-up below for each day, the slides in the power point including the notes for each slide, and the participant handouts.

Day 1: Post-Test

Participants take the Post-Test. Participants who finish early can begin to explore the Climate Change Interactives if they have devices and there is sufficient connectivity. Alternatively, they can examine one of the PCEP books that will be explored in the next weeks. If you have time after everyone finishes, you can review some of the test questions and responses, especially the open-ended prompts.

Day 2: Explore the Climate Impacts Interactive (computer lab and classroom)

Begin the session in the computer lab unless you have sufficient connectivity, devices, and space in the classroom. Participants can get to the Climate Change Impacts interactive by going to <http://pbslearningmedia.org> and searching for “impacts climate change pacific region.”

Get attention of the participants and **Show Slides 1 through 3** to quickly set the context of the three interactives, especially the focus on this third interactive. As the presenter, **Open**

and Display the Climate Impacts interactive. Demonstrate how they can move back and forth across screens using either the middle side arrows, or the grey navigation bars on the top right. Show the second screen of the interactive to focus on the four different main impacts of climate change. Tell participants they will work in teams of two, and assign one of the four impacts to each team so that all four impacts are covered by roughly the same number of teams.

Distribute the Impacts of Climate Change handout. Also each participant should get one blank page to take notes on their assigned climate change impact (first page from the file named CC_Impact.docx). Still displaying the second screen of the interactive, click on the top arrow and also click on one of the impacts to show the kind of information that they reveal. **Show Slide 4** and leave it displayed to guide the participant exploration of their assigned climate change impact. Highlight that they should not use information from the final page of the interactive as that will be explored in more detail later in the session.

When all the participant teams have collected and written sufficient information, have them close the interactive. If there is enough room and time to work in groups in the computer lab, they can stay there. Otherwise, you should transition back to the classroom. Each team will now meet in a group with one or more other teams that have explored the same climate change impact that they explored. Working as a group, they will create a poster that explains what they learned about that climate change impact.

When they have completed their poster, the groups should paste them in a visible location. Posters about the same climate change impact should be near each other. Distribute three blank climate impact sheets to each participant. Have the groups present about their impact in the order Higher Air & Ocean Temperatures, then Changing Rain Patterns, then Sea Level Rise, and finishing with Ocean Acidification. You can **Show Slides 5 and 6** or the **Third and Fourth Screens from the Interactive** to support the group presentations. You can use the four instructor pages from the file named CC_Impacts.docx as a backup guide. Participants should take notes about each of the climate impacts on their individual sheets during these presentations.

Show Slides 7 through 12 to introduce the concept of climate adaptation in the context of ecosystems. Depending on participant prior knowledge and time available, find the appropriate blend of small group discussion, presenter lecture, and whole group discussion/consensus building. Slide 10 is the key conclusions slide. Slide 11 helps clarify the different uses of the term *adaptation* with respect to biological adaptation and climate change adaptation. Slide 12 reinforces Slide 10 by showing the same big idea as it appears in the interactive.

Show Slide 13 to transition from ecosystem climate adaptations to human system climate adaptations. **Show Slide 14** and distribute the Sea Level Rise handout. Have participants engage in small group discussions about ideas for the categories of adaptations. Depending on time, separate groups could focus on different adaptations or everybody could consider all the categories. **Show Interactive Screen 5 and/or Slide 15** during the ensuing whole

class discussion. If you are displaying the interactive, you can click on each Adaptation category to view further information, as shown for water security in **Slide 16**.

Day 3: Investigating Carbon in the Ocean

Begin the session by **Showing Slides 17 and 18**. Use Slide 17 to introduce the topic and Slide 18 to connect today's session with the Climate Impacts interactive. During the previous day, we learned about ocean acidification as one of the major climate change impacts. Today, we are learning more about how the carbon gets into ocean water where it then makes the water more acidic.

Show Slide 19 to help participants access their memories of using BTB color changes to monitor when carbon dioxide enters and leaves water (OSS Session 2.2 in Week 8 of this course). Slide 19 reinforces the importance for photosynthesis of carbon dioxide dissolving in water and **Show Slides 20 and 21** to also connect this dissolved carbon dioxide with the role of carbon containing shells in marine organisms and ecosystems. **Show Slide 22** to then introduce the main question and investigation for the day.

The main investigations are based on OSS Session 2.5 where learners compare the rate of carbon dioxide dissolving in still water and in water that is agitated to mimic storms and how winds increase the rate of dissolving. Using BTB to monitor the dissolving of carbon dioxide demonstrates that this process causes an increase in acidity. The connection to pH can be further strengthened by showing that vinegar (a weak acid) causes the same color change as dissolving carbon dioxide. Ammonia (a base) causes a completely different color change.

You can do the investigations as they are described in OSS 2.5. These are very teacher-directed. Alternatively, you can use a more learner-centered approach where the participants are challenged to develop their own ideas on how to compare the dissolving of carbon dioxide in water under calm versus stormy conditions, and also the effects of acidity on shelled organisms. You can help guide those discussions so the materials that you have assembled can be appropriate for their investigation ideas.

You can also connect ocean acidification with its negative effects on carbonaceous shells by setting up demonstration containers that have shells or chalk in water ranging from basic to neutral to weakly acidic and strongly acidic.

Show Slide 23 to summarize what we have learned about ocean acidification. Ocean acidification is technically not a change in climate. However, ocean acidification is generally included as a climate change impact since the main cause of climate change (human activities that add carbon dioxide to the atmosphere) is also the cause of current and projected ocean acidification. Also higher ocean temperatures due to climate change and ocean acidification can reinforce each other to cause great harm to key ocean ecosystems such as coral reefs.

Homework Assignment is to write about our Two Guiding Reflections (same questions used at the end of every week):

- 1) Choose a concept or activity from this week. How would you teach this concept or activity with your students?
- 2) What would be hard for your students to understand about this concept or activity?