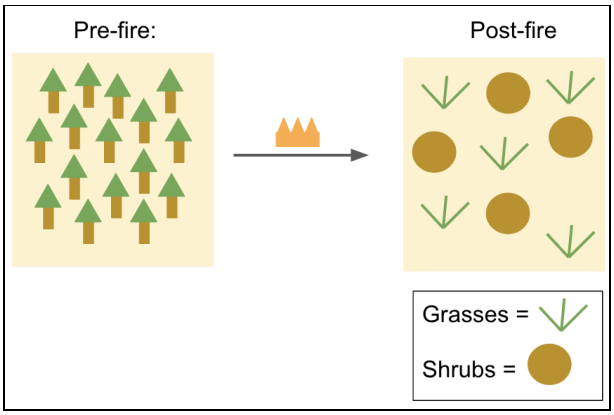
The Future of Forests

Putting Pieces Together - Teacher Guide

Setting the Stage



From 2004-2012, Dr. Derek Young from the University of California Davis surveyed regenerating (vegetation) plots from 14 different fire-affected landscapes across northern California. Through his work, Dr. Young discovered that grasses and shrubs regenerate well in dry conditions, a result that has important implications for post-fire forest regeneration. Scientists across the west agree that if patterns in soil moisture conditions continue, post-fire conifer regeneration will decline while grassland and shrubland regeneration will increase. In other words, the forests of today could transition to grassland or shrubland after a wildfire.

Lesson Overview

In this lesson, students will work in pairs to reference empirical evidence and scientific reasoning (obtained from previous lessons) to argue that low soil moisture conditions (drought) has prevented some fire-affected landscapes from recovering to their pre-fire conditions.

- *Part 1 – (20 minutes) Future Forests*
  Students evaluate the impact of drought-like conditions on secondary succession by engaging with post-fire regeneration data collected from northern California.
- *Part 2 – (10 minutes) Update Summary Table*
  Students reflect on what they learned in Part 1 and how it relates to the unit driving question.
- *Part 3 – (20 minutes) Putting the Pieces Together*
  Students work in pairs to answer questions requiring them to reflect upon and provide evidence for their learning as it relates to the unit driving question, “How do landscapes recover after a fire?”
- *Part 4 – (10 minutes) Gotta-Have Checklist*
  Students work as a whole class to create a checklist (~5-10 items long) of all ideas/concepts necessary to explain the unit driving question.

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Instructional Overview	
Grade Level	Middle/High School
Instructional Time	60 minutes *(total time needed)*
Unit Driving Question	How do landscapes recover after a wildfire?
Lesson Driving Question	In a future where drought-like conditions are expected to persist, which vegetation types (conifer trees, grasses, shrubs) are most likely to regenerate after a wildfire?
Building Toward	Middle School: MS-LS2-4, MS-ESS3-3 High School: HS-LS2-7
Three Dimensions	**Science and Engineering Practices:** ● Engaging in Argument from Evidence **Disciplinary Core Ideas:** *Middle School:* ● LS2.C: Ecosystem Dynamics, Functioning, and Resilience ● ESS3.C: Human Impacts on Earth Systems *High School:* ● LS2.C Ecosystems Dynamics, Functioning, and Resilience **Crosscutting Concepts:** ● Stability and Change
What Students Will Do	● Reference empirical evidence and scientific reasoning (obtained from previous lessons) to argue that human-caused drought has prevented some fire-affected landscapes from recovering to their pre-fire conditions.
Materials	❑ Putting Pieces Together PPT ❑ Putting Pieces Together Student Worksheet (1 per student) ❑ Answer Key ❑ Butcher paper or online document to create “Gotta-Have Checklist” ❑ Initial Ideas Public Record ❑ Summary Table
Material Preparation	❑ Cue and test web links ❑ Print student worksheets ❑ Review speaker notes in the Putting Pieces Together PPT ❑ Review Answer Key ❑ See Gotta-Have Checklist example ❑ Display summary table and initial ideas public record
Vocabulary	No new vocabulary

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Part 1 - Future Forests (20 minutes)

Refer to Part 1 slides including in the Putting Pieces Together PPT. See PPT presenter notes for additional information.

1. Students complete their warm up, "How have low soil moisture conditions (drought) impacted the process of secondary succession?" and share their ideas with the class.
    a. In the previous lesson, "Landscape Recovery Case Study", students learned that conifer trees struggle to regenerate in low soil moisture conditions. Have students consider what post-fire vegetation types might become more common in the absence of conifer trees *(Answer: grasses, shrubs, and other pioneer species)*

2. Introduce students to the "Post-fire forest regeneration in northern California" study conducted by scientists at the University of California Davis. Refer to slides #5-7 for study background and results. Engage the students in a series of whole-class discussions related to the figures/datasets included.
    a. Note that the results of the study suggest that grasses and shrubs fair better in drier conditions.

3. Students work in pairs to discuss and respond to the following scenario. *"A forest is destroyed following a large wildfire. Drought-like conditions persist in the area for the next 20 years. Predict which plant types (grasses, shrubs, trees) will most likely regenerate (regrow) in this fire-affected landscape."*

Part 2 - Update Summary Table (10 minutes)

Refer to Part 2 slides including in the Putting Pieces Together PPT. See PPT presenter notes for additional information.

1. Students work in groups to reflect on their learning and how it relates back to the unit driving question, "How do landscapes recover after a wildfire?"

2. Facilitate a discussion in which students come to a consensus about what they learned and how it helps them understand the unit driving question. Ideas/concepts agreed upon by the class should be included in the whole class summary table (see Answer Key).
    a. Students record new summary table entries onto their own summary tables.

Part 3 - Putting Pieces Together (20 minutes)

Refer to Part 3 slides including in the Putting Pieces Together PPT. See PPT presenter notes for additional information.

1. Students work in pairs to answer Part 3 questions. Students should reference lessons/activities they've completed as evidence when describing new concepts.
    a. The questions have been designed to help students connect the dots and explain how landscapes recover after a wildfire.

Part 4 - Gotta-Have Checklist (10 minutes)

Refer to Part 4 slides including in the Putting Pieces Together PPT. See PPT presenter notes for additional information.

1. Students work in pairs to create a list of 3-5 ideas/concepts they think must be included in a final descriptive models/written explanation of the unit driving question (refer to Putting Pieces Together PPT).

2. Teacher facilitates a whole-class discussion in which students share their lists. Before adding an idea/concept to the Gotta-have checklist, make sure the class has come to a consensus. A completed checklist (~5-10 items long) should contain all ideas/concepts necessary to explain the unit driving question.

3. Review each idea/concept on the Gotta-have checklist and ask students to consider what evidence they have for each bullet. This could be quantitative data, the name of a simulation or video, or the title of a lesson/lesson part they completed. Record the evidence in a separate color next to the corresponding bullet idea/concept (see Gotta-Have Checklist Example)
    a. Note: Students will refer to the Gotta-have checklist when developing their final models and writing their final explanations for the unit driving question (Lessons 8 and 9).