



# The Future of Forests

## Citizen Science with GLOBE - Teacher Guide

### Setting the Stage

Scientists are trying to evaluate and monitor the impact of wildfires and other natural/human disturbances (e.g., flood, logging) have on the landscape. However, it is impossible for just a few scientists to monitor the vast landscapes that comprise the United States...they need help from citizen scientists! NASA's GLOBE program has developed an app that includes various data collection protocols (e.g., Land Cover) to allow the public to quickly and easily engage in citizen science! In this lesson, students use the Land Cover protocol within the GLOBE Observer app to make observations of the land cover in their area. These land cover observations are essential to 1) establishing baseline conditions, 2) monitoring landscape changes, and 3) evaluating post-disturbance recovery.



Photo Credit: [GLOBE](#)

### Lesson Overview

In this lesson, students will evaluate and monitor changing landscape conditions by engaging in citizen science with the Land Cover app within NASA's GLOBE Observer app.

- *Part 1 – (15 minutes) Citizen Science*  
Students are introduced to citizen science by watching a video and engaging in small and large group discussions.
- *Part 2 – (60 minutes) GLOBE Observer - Land Cover app*  
Students participate in citizen science by gathering land cover observations using NASA's GLOBE Observer app.
- *Optional Activity – (45 minutes) Landscape Quilt*  
*Facilitated in conjunction with Part 2, students draw an image of the landscape (highlighting different plant communities) to identify land cover patterns.*

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Instructional Overview	
Grade Level	Middle/High School
Instructional Time	120 minutes ( <i>total time needed</i> )
Unit Driving Question	How do landscapes recover after a wildfire?
Lesson Driving Question	How can we (the public) help scientists conduct their research?
Building Toward	Middle School: <a href="#">MS-LS2-4</a> , <a href="#">MS-ESS3-3</a> High School: <a href="#">HS-LS2-7</a>
Three Dimensions	<p><b>Science and Engineering Practices:</b></p> <ul style="list-style-type: none"> <li>Obtaining, evaluating, and communicating information</li> </ul> <p><b>Disciplinary Core Ideas:</b></p> <p><i>Middle School:</i></p> <ul style="list-style-type: none"> <li>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</li> <li>ESS3.C: Human Impacts on Earth Systems</li> </ul> <p><i>High School:</i></p> <ul style="list-style-type: none"> <li>LS2.C Ecosystems Dynamics, Functioning, and Resilience</li> </ul> <p><b>Crosscutting Concepts:</b></p> <ul style="list-style-type: none"> <li>Stability and Change</li> </ul>
What Students Will Do	<ul style="list-style-type: none"> <li>Evaluate and monitor <b>changing landscape conditions</b> by engaging in citizen science with NASA's GLOBE Land Cover app.</li> </ul>
Materials	<ul style="list-style-type: none"> <li><input type="checkbox"/> <a href="#">Citizen Science with GLOBE PPT</a></li> <li><input type="checkbox"/> <i>No Student Worksheet</i></li> <li><input type="checkbox"/> Devices (ipad or cell phone) with the <a href="#">GLOBE Observer app</a> pre-installed</li> <li><input type="checkbox"/> <a href="#">"What is Citizen Science" video</a></li> <li><input type="checkbox"/> <a href="#">"Why Observe: Land Cover" video</a></li> <li><input type="checkbox"/> <a href="#">"GLOBE Observer: Land Cover - Getting Started" video</a></li> </ul> <p>Optional Resources</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> <a href="#">Land Cover Science</a> webpage</li> <li><input type="checkbox"/> <a href="#">Land Cover Guide</a> (1 per student)</li> <li><input type="checkbox"/> <a href="#">Landscape Quilt Student Worksheet</a> (1 per student)</li> <li><input type="checkbox"/> <a href="#">Landscape Quilt example</a></li> <li><input type="checkbox"/> Watercolor paints, colored pencils, crayons, etc.</li> <li><input type="checkbox"/> Clipboards</li> </ul>
Material Preparation	<ul style="list-style-type: none"> <li><input type="checkbox"/> Cue and test web links</li> <li><input type="checkbox"/> Make sure students have devices with the <a href="#">GLOBE Observer app</a> pre-installed</li> <li><input type="checkbox"/> Review speaker notes in the <a href="#">Citizen Science with GLOBE PPT</a></li> </ul>



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	<ul style="list-style-type: none"><li><input type="checkbox"/> Review the <a href="#">Land Cover Science</a> webpage</li><li><input type="checkbox"/> Review the <a href="#">Landscape Quilt example</a></li><li><input type="checkbox"/> Print <a href="#">Landscape Quilt Student Worksheet</a> (1 per student)</li></ul>
<b>Vocabulary</b>	No new vocabulary
<b>Instructional Strategies</b>	This lesson contains both in-class and outdoor components with an optional activity (Landscape Quilt) built in for classrooms to choose this

## Part 1 - Citizen Science (20 minutes)

Refer to Part 1 slides including in the [Citizen Science with GLOBE PPT](#). See PPT presenter notes for additional information.

1. Students complete their warm up, “What is citizen science?” and share their ideas with the class.
2. Watch the [“What is Citizen Science” video](#).
  - a. Facilitate a discussion around the following prompt, “Why do think scientists need help gathering and analyzing scientific data?”
    - i. Answer: Scientists often don’t have enough time or resources (e.g., money) to gather datasets over large spatial and temporal (time) scales.
  - b. An example of this is monitoring the post-fire recovery of landscapes across the western United States (refer to slide #6)

## Part 2 - GLOBE Observer - Land Cover app (60 minutes)

Refer to Part 2 slides including in the [Citizen Science with GLOBE PPT](#). See PPT presenter notes for additional information.

1. Refer to the Citizen Science with GLOBE PPT (slide #7) to introduce students to the NASA-funded GLOBE program.
  - a. Note that classrooms around the world have participated in citizen science with GLOBE.
  - b. Say, “*GLOBE now has an app called “GLOBE Observer” which makes it easy to gather important data for scientists with your cell phone! We will be focusing on the Land Cover protocol within the app.*”
2. Facilitate a discussion with students around the following question, “Why do scientists study land cover?”
  - a. Answer: Understanding the Earth’s land cover and how it changes is important for 1) analyzing the hazards associated with floods, fire and landslides, 2) mapping wildlife habitat, 3) tracking the impacts of climate change, among many other reasons.



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Teacher tip:

Review the GLOBE [“Land Cover Science”](#) page to learn more about the importance of land cover research.

**Optional Activity:**

Have students visit the [GLOBE “Land Cover Science” page](#) to learn more about the importance of land cover research. Consider facilitating a jigsaw activity where students become experts on the impact of land cover on ecology, the water cycle, etc. and then report their new understandings back to the class.

3. Watch the [“Why Observe: Land Cover” video](#) (7:40).
4. Say, *“While we focused on wildfires in this curriculum, there are many other factors/events that could alter the landscape.”* Then, create a whole class list of factors or events that could alter/change the landscape.

Teacher note: This is an important activity as not all schools are close to fire-affected areas. Students need a reason to be motivated to use the GLOBE Land Cover app, and by identifying factors/events that could change the landscape in their area, students are more likely to understand the importance of monitoring land cover changes.

5. Demonstrate for students how the GLOBE Land Cover app by showing the [GLOBE Land Cover - Getting Started video](#). Then, have students use their device (either ipad or cell phone with the GLOBE Observer app pre-installed) practice using the Land Cover app in the classroom (see Teacher tips below).
  - a. Note that the Land Cover app has an option that allows users to classify the different plant types students observe. Should you require students to complete this step in the protocol, we suggest reviewing this [Land Cover Guide](#) as a whole class (option to print copies for students).
6. Once students feel comfortable using the app, students may go outside (either during class time or on their own) and begin gathering land cover observations.

Teacher tips:

- Download and test the app by making a Land Cover observation before introducing the app to students. Be prepared to register with an email address.
- Be sure students have access to a device (ipad or cell phone) with the GLOBE Observer app pre-installed.



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- We recommend either having students download the app on a personal device or having the app downloaded onto district ipads. Put students into groups if devices are limited.
- To use the app, students must register with an email address.

## **Optional Activity: Landscape Quilt (45 minutes)**

If you are taking students outside to use the GLOBE Land Cover app while at school (e.g., teacher takes students to a local forest, park, etc. to gather land cover observations) we recommend facilitating the following “Landscape Quilt” activity as well to help students identify land cover patterns. We’d suggest having students first create their landscape quilts before they engage with the GLOBE Land Cover app. (see [slides #14-16](#))

### Background

A landscape quilt is a drawing representing a landscape that highlights sections of different plant communities or areas that have been altered/changed by human or environmental events. By closely observing and recording the patterns in the landscape students are able to 1) draw conclusions about *why we see what we see where we see it* (e.g., abiotic factors), and 2) establish baseline conditions to monitor changes to the landscape.

### Materials

- [Landscape Quilt Student Worksheet](#) (see example [here](#))
- Clipboard
- Watercolor paints, colored pencils, crayons, etc.

### Procedure

1. Select a spot outside, at least 10 meters (~30 ft) from the nearest person.
2. Observe the landscape and the different plant communities and human structures in view.
3. Choose graphic symbols to represent each plant community you see (e.g., triangles to represent evergreen trees, dots for grass, circles for water, square for a building, etc.)
  - a. Be sure to include these graphic symbols in your key!
4. Now draw the landscape you see around you beginning at your feet and ending at the horizon - in other words, from foreground to background.
  - a. We recommend providing students with the option to use watercolors, colored pencils, crayons etc. when constructing their landscape quilts.

### Debrief

Facilitate a whole class discussion using the following prompts:

- What patterns did you notice while drawing your landscape quilt?
- Think of 3 abiotic factors - which of these could affect where plants grow? - how?
- Was one plant type or human structure more prevalent (common) than another?
- What effect might the slope angle and aspect (direction) have on plant communities?