

Cool Carbon Sink Oaks

Key Topics: Human Impact, CO2 Emissions/Cycle, Biosphere, Atmosphere, Fossil Fuels, Oaks

Grade Levels: K-8

Inside and Outside

Lesson Overview:

In this lesson students will get a hands-on look at the carbon cycle, where carbon is stored in their local environment (organic matter), and the importance of carbon as the building blocks of all life, and the importance of native oaks. Humans have an influence on the natural process of carbon cycling, but how can we have a positive influence to reduce climate change? We will be growing our own oaks!

Activities:

Option 1 - Cookie Ring Study (10 minutes)

Option 2 - Carbon Cycle Role Play (15 minutes)

Option 3 - Oak Planting and Wrap Up (35 minutes)



Suggested Activities and Learning Objectives by Grade Level:

- K: Oak Planting
 - K-ESS3-3 How can we remove carbon from the air?
 - K-PS3-1 How do plants use sunlight?
- 1: Cookie Ring Study, Oak Planting
 - 1-ESS1-2 How do tree rings change throughout the year based on available sunlight/day length?
- 2: Cookie Ring Study, Carbon Cycle Role Play, Oak Planting
 - 2-ESS1-1 How can we use tree rings to determine changes in climate?
 - 2-ESS1-1 How long does it take to add or remove large amounts of carbon from the atmosphere?
- 3: Cookie Ring Study, Oak Planting
 - 3-LS3-2 How does a tree's environment affect its growth?
- 4: Carbon Cycle Role Play, Oak Planting
 - 4-ESS3-1 How does human fuel use affect the carbon cycle?
- 5: Cookie Ring Study, Carbon Cycle Role Play, Oak Planting
 - 5-ESS3-1 How can we use tree rings to understand and protect the environment?
- MS: Cookie Ring Study, Carbon Cycle Role Play, Oak Planting
 - MS-ESS3-5 What natural and human processes influence the climate, and how do we know?

Essential Question(s) that Connect CCCs and SEPs:

- How do scientists measure changes in the climate through dendrochronology (study of tree rings)? In periods of drier climate the trees grow less. What would the distance between the rings look like? (The rings are smaller and more compact.) During periods of time when there was a more moist climate the trees grow more. What would the distance between the rings

look like then? (The rings would grow wider apart from more expansion.) ([Cause and Effect](#); [Engage in Argument from Evidence](#))

- How did carbon get into the air? There are both natural and human sources of carbon dioxide emissions. What is a natural source of carbon emissions? What is a human caused source of carbon emissions? ([Cause and Effect](#); [Asking Questions and Defining Problems](#))
- How can we model the cycling of carbon? ([Energy and Matter](#); [Developing and Using Models](#))
- How have human actions changed the carbon cycle to make it less stable? How can I best communicate what I've learned about oak trees and stability and change in this system? ([Stability and Change](#); [Obtaining, Evaluating, and Communicating Information](#))

Materials:

- Large laminated copy of cross-sections of different trees
- 'Cookies' of different trees
- [Carbon Cycle Role Play Cards](#)
- [Carbon Cycle Script Lines](#) (cut the script lines out for each group; this can be laminated)
- Chalk to label areas if doing role play outside: atmosphere, land, and ocean
- At least one used milk carton per student
- Potting soil or compost and dirt mix
- Gathered and stored oak acorn varieties (pre-tested with the sink or float test)

EG Team Support Needed:

- Collect oak acorns

Prep:

This lesson can be taught 100% outside if desired! If teaching the activity outside choose an area for the carbon cycle role play (preferably on blacktop so you can label 3 areas: atmosphere, land, and ocean). In case of rain, the oak tree planting can be done inside of the classroom. Bring newspaper to lay out for easy cleanup!

- Gather used milk cartons or other recycled containers in advance
- Plan with teacher how the oak seedlings will be cared for and where they will be staged. Examples: 1) teacher and class water 2-3x week; Garden Club waters 1x week (with your help) and class does rest
- Gather acorns ahead of time (at least 1 per student) and test if test viability through the "sink or float" test (See planting activity guide below for how-to). Walk campus to note if and where there are oak trees for students to collect their own acorns from. In preparation for guiding students to grow acorns into oak tree seedlings, [review the following information](#) (the activity on page 51 specifically).

Activity Procedure:

Engage:

Breathe in (that is oxygen!) Breathe out (that is carbon dioxide!) Say what? Carbon is an element on Earth and is a building block to all of Life. Do you know who breaths in what you breath out? Trees! That's right, trees breath in carbon dioxide. Carbon dioxide, or CO₂, is a molecule of carbon attached to two molecules of oxygen--plants breathe it in through tiny holes, or 'stoma', in their leaves and convert it to your favorite food--sugar--to store energy from the sun. At night, they break down the sugar, breathe

out oxygen. So plants and people breathe opposites! The mighty oak is a mascot for our community. Especially, El Paso de Robles (which means “Pass of the Oaks” which explorers named the city of Paso Robles because of all the oaks they encountered).

Read some interesting [facts about the oak tree](#):

- Native to the Northern Hemisphere.
- Typically live 250 years and can produce over 450 lbs of acorns in a year.
- Acorns were a major food source of the indigenous people of our area (Salinan and Chumash).
- It takes 20 or 30 years before oaks produce their first crop of acorns.
- There are 600 species of oak, North America has the largest number with 90 in the U.S. and 160 in Mexico. China has 100 species.
- The oak tree fruit is called a nut or acorn. Each acorn has one seed.
- Depending on the species, each acorn takes 6-18 months to mature.
- The leaves and the acorns have a substance that protect it from fungi and insects.
- The oak leaf is used to represent multiple medals and awards for the United States Army or Air Force or the United States Green Building Council– it is called the oak leaf cluster.
- A 50-year-old oak forest sequesters about 30,000 pounds of carbon dioxide per acre! This forest would be emitting about 22,000 pounds of oxygen.

Explore:

Ask students to raise their hands to share:

How do scientists know what the weather was like in the past? How does climate affect tree growth?

How do scientists measure changes in the climate through dendrochronology (study of tree rings)?

Scientists can study tree rings to tell when there were drier or wetter periods in time. In periods of drier climate the trees grow less. What would the distance between the rings look like? (**The rings are smaller and more compact.**) During periods of time when there was a more moist climate the trees grow more.

What would the distance between the rings look like then? (**The rings would grow wider apart from more expansion.**) (**Cause and Effect; Engage in Argument from Evidence**)

Action:

1. Break students into groups of 4-5. Having students work with the classmates they are already sitting with works well here.
2. Pass out one laminated tree ring picture to each group. Instruct students to count the rings in their photo of a tree slice. Do you see any evidence that this tree lived in a dry period of time? Did this tree live in a wet period of time? How can you tell?
3. Don't spend too much time on this, as we are mostly focused on the carbon cycle and oak tree planting. This is mostly to engage them in a phenomenon! We want them to wonder and pause to recognize how long a tree can live and that it carries wisdom as it endures many physical changes through its lifetime.

“Trees are filled with wisdom. Let's take a moment to count how many years they have actually been around before giving their life to something else.... 100 years?” Count rings with them or tell them to estimate and create an easy way to measure that with your fingertip.

Explain:

This lesson is about oaks AND carbon. Carbon is a natural element in our environment. It lives in everything that is or was once living. Ask students to make educated guesses about things think may

contain carbon. Explain to your students that the carbon contained in any one thing doesn't stay there forever. The carbon atoms move from one thing to another in what is called the carbon cycle. Parts of the carbon cycle happen very quickly, like when plants take in carbon dioxide from the atmosphere for photosynthesis. But, other parts of the carbon cycle happen very slowly.

Tell students that in this activity, they will learn how carbon moves from one place to another, by performing a carbon cycle role-play.

Action:

- 1) Designate a large open space for this activity.
 - a) If working inside, draw a picture on the board of the three regions shown below and then designate different areas of the classroom to represent the ocean, the land, and the atmosphere.
 - b) If working outside, either draw the picture on the whiteboard or use chalk to draw out the regions shown below on blacktop.
- 2) Divide students evenly into 7 groups and distribute the appropriate [role-play card](#) and [carbon cycle script lines](#) to each group. Each group will be a team of actors that will play a certain part of the carbon cycle (**atmosphere, water, algae, marine snail, sediments & rocks, trees, or caterpillars**).
- 3) Distribute **2-4** 'cookies' to each group and explain that these represent carbon atoms.
- 4) Have students in each group review their role play card to figure out their role in the carbon cycle and decide as a group using their "Options for carbon movement" how they are going to move their carbon.
- 5) Explain that they can give their carbon to only one other group, or if they have plenty, they can give the carbon to more than one group.
- 6) Explain that carbon exists in all of these things at the same time and only a portion of the carbon in each thing moves. Therefore, when each group moves their carbon, they can't give away all their carbon: **they must keep at least one carbon atom**.
- 7) As they move their carbon, they must say their script lines to explain the carbon movement that they have chosen.
- 8) One at a time, ask each group to give their carbon to another group (or groups).
- 9) Run the role-play a number of times, telling students to make different choices about carbon movement each time.
- 10) If you have time, consider running the following variations:
 - **Have all the groups moving their carbon at the same time:** Have one person from each group be the deliverer of carbon and the other group members remain to receive carbon from other groups. Tell students that this is a more chaotic, but more realistic acting out of the carbon cycle, since in the real world carbon moves between all these areas at the same time.
 - **Trace the journeys of only few carbon atoms:** Use only one carbon atom ('cookie') and start it with one group. Each group that gets the atom makes a decision about where it goes next. Assign one student to write the journey on the board or a piece of paper. Do this multiple times so that you can compare the journeys of several individual atoms through the different spheres and see how the carbon cycle does not move in one direction, but moves in lots of different directions at the same time.

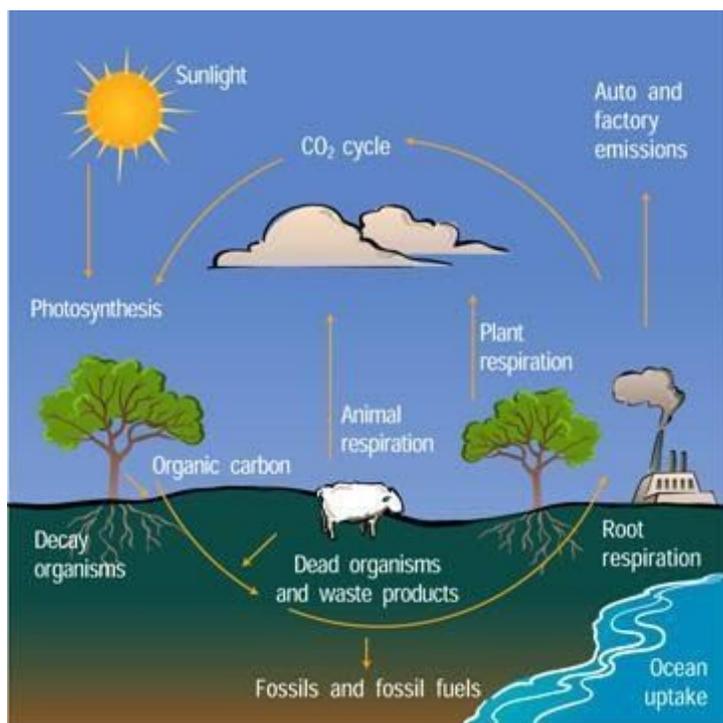


Ask students to raise their hands to share:

What do you think trees are made of? Carbon is one of the main components! Carbon lives in everything that is or was once living.

Where do trees get their carbon from? They take carbon dioxide in from the air during photosynthesis and use the energy of the sun to use it like Legos and grow.

How did carbon get into the air? There are both natural and human sources of carbon dioxide emissions. Let's take a look at this diagram to understand the carbon cycle: use [this diagram](#) (either display the laminated diagram OR draw your own with this example on the whiteboard). For K-2 use [the oxygen cycle diagram](#); have students color their own or display for the class to see.



What is a natural source of carbon emissions? What is a human caused source of carbon emissions? (Cause and Effect; Asking Questions and Defining Problems) How can you tell the difference? The [main release of carbon into air and water is from fossil fuels](#). Explain to students that they just acted out the carbon cycle without human involvement, but humans greatly influence the carbon cycle with some of their activities. Explain that humans have not created more carbon on earth, but that we move carbon from one place to another more quickly than would naturally happen and that this has consequences for the climate of the planet.

Ask students to imagine sitting inside of a car on a hot day. If the windows are rolled all of the way up, light from the sun enters through the glass windows and the heat is trapped inside. The heat can't escape until the windows are rolled down! Carbon dioxide in the air or atmosphere acts the same as the window rolled all of the way up. Light from the sun enter into the Earth's atmosphere and the layer of

carbon dioxide in the atmosphere traps the heat around the earth. Too much carbon dioxide in the atmosphere is causing the world's climate to change.



Ask students to raise their hands to share:

How can humans change the flow of the carbon cycle to reduce the amount of carbon dioxide in the atmosphere?

How can you best communicate what you've learned about oak trees and **stability and change** in carbon cycling? (**Stability and Change; Obtaining, Evaluating, and Communicating Information**) Have students think about the movements that the atmosphere team made in the carbon cycle activity. Where can the carbon go? Since we know trees absorb, or 'breath in', carbon dioxide when they grow (wood is made of carbon), (urban) forests help reduce the amount of carbon dioxide being released to the atmosphere. Another solution could be right below our feet. The soil! When trees and plants die, carbon gets stored a lot in here. Stored soil carbon has the potential, very much so in industrial agriculture, to be released via tilling and constant digging. Mulching and composting are practices that increase carbon storage in the soil. Trees are great ways of storing carbon so it stays in balance with what is in the air! Another way of saying "carbon storage" is by saying "carbon sinks".

Elaborate:

Let's go ahead and plant cool carbon sink oaks! Review the scanned guide on planting acorns properly [HERE](#) for more information if needed. (Page 51 has instructions for collecting and planting acorns)

Action:

- 1) If there is an oak tree on campus, walk students over to the tree for an observation. What are their thoughts when looking at the oak? Gather any acorns with students. If students find acorns, have them do the sink or float test!
 - a) **Sink or Float Test:** Take the caps off the acorns, place the acorns in a container and cover them with water. Immediately remove any acorns that float and save them. Allow the rest of the seeds to soak for at least 12 hours. Remove any new acorns that float and keep them with the other "floaters." Drain off the water, let all of the "sinkers" either dry if you will be storing them or remain wet if you will be planting them.
- 2) Ask the students to propose ideas or hypotheses about why the "floater" acorns don't sink with the rest. Record their ideas on chart paper or a whiteboard. Pass around a "floater" acorn that you cracked open with evidence of maggots or insects burrowing inside.
- 3) Give students a "sinker" acorn, and have them make observations and measurements (color, length, and overall size and appearance).
- 4) Demonstrate how to plant an acorn. Allow each student or group to prepare and fill a container with soil, and plant an acorn.
 - a) Plant the acorn sideways, not pointing up or down

- b) Plant the acorn at the depth double its size
- 5) Lead a discussion on the physical requirements needed for oak seedlings to grow:
 - a) What does an acorn need to grow?
 - b) How can you tell if it needs water?
 - c) How much water should you give to your seedling?
 - d) How will you know if you have given it too much water?
 - e) How much light should it get?
 - f) How do its roots grow?

Give each student an “Oak Seedling Care Pledge” certificate. Read the pledge together as a class, and have each student sign and date their certificate.

Evaluation:



Ask students to raise their hands to share:

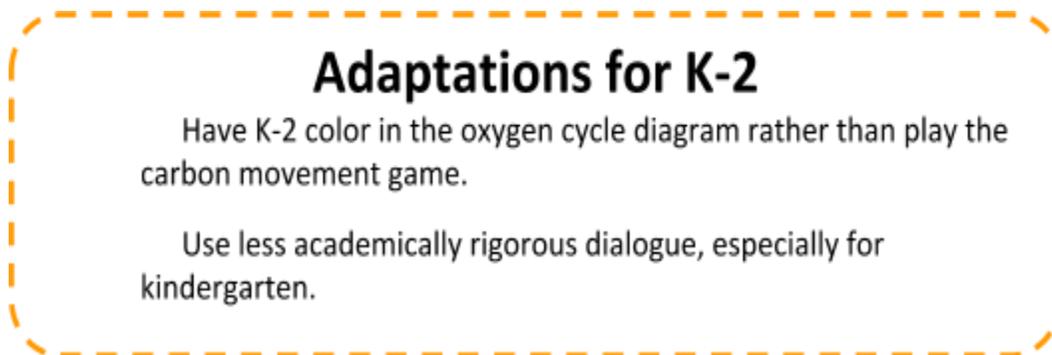
Let's name three ways that humans can reduce carbon emissions through our actions. (Use less fossil fuels, plant and protect trees, mulch soil). How do trees such as the mighty oak trees help our environment?

Also, refer back to the Learning Objectives for your grade level and ensure that they have been met by asking the given learning objective question.

Extension Activities:

- The Soil Story with Pashon Murray
 - <https://www.youtube.com/watch?v=npu6GBbB-Oc&app=desktop>
- [Big Rooty tackles erosion and heat on landscapes](#)
- Plant the oak trees that students started from acorns! The trees could be planted on campus (have a discussion with principal) or sent home with kids to be planted if they have a yard. Have students discuss considerations with kids, as oak trees get very large!

Tips and Caveats:



Note from Gloria Wilson, GEM: For the kinder kids, we spent a few minutes discussing how trees help us to live by giving us oxygen to breathe, and we help the trees to live by putting carbon dioxide back into the air for them to use. After this we talked about oaks and how acorns are the seeds of

oaks. We also looked at some oak leaves that had blown into the garden and then planted our acorns! In the future I'd like to visit an oak with the kids and allow for some tactile exploration. Maybe getting them to do a little yoga (baby-pose for the acorn, hero pose for sprout, and tree pose for, well, tree).

Cited Curriculum:

- [Measuring Carbon Sequestration in Schoolyard Trees and Global Sustainability of Carbon Stores](#) by Michigan's Newberry Middle School
- <https://www.calacademy.org/educators/lesson-plans/carbon-cycle-role-play>