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UNIT

## Carbon Trackers

In this unit, students act as scientists seeking to understand the ways matter and energy move through the carbon cycle by conducting research, collaborating with others, and completing a series of tasks, including iterative modeling. The model grows in complexity as students increase their understanding of various cycles on Earth. Finally, they present a collaborative model to educate and inspire an audience to more carefully consider human use of fossil fuels.

**GRADES**

6 - 8

**SUBJECTS***Earth Science, Climatology***CONTENTS**

3 Lesson plans

For the complete unit with media resources, visit:

<http://www.nationalgeographic.org/unit/carbon-trackers/>

## In collaboration with



## UNIT OVERVIEW

Through readings, videos, hands-on experiments, and iterative modeling, students seek to better understand the way energy moves through the global carbon cycle and maintains Earth's systems. Students' models grow in complexity as they deepen their understanding of various cycles on Earth, including the water cycle, the rock cycle, and photosynthesis and

respiration, as well as the interconnections between these cycles. They explore the power of using a collaboratively created model to educate an audience and convey the importance of considering human use of fossil fuels.

In an opportunity for further action, students can choose to transform the scientific model into an art piece to be displayed in an art, science, or natural history museum or public space, with the goal of inspiring others to learn about Earth's systems, matter, and energy cycling.

Use this [unit at a glance](#) to explore a brief outline of the materials included in this unit.

**Unit Driving Question:** *Where does the energy in fossil fuels come from and where does it go?*

## LESSON 1: TRACKING CARBON TO UNDERSTAND ITS FLOW | 3 HRS 20 MINS



Students learn about the Darvaza Crater and ponder what keeps it burning. Then they analyze the Keeling Curve and consider the source of the increasing atmospheric carbon dioxide. In the activities to follow, they explore fossil fuel formation, use, benefits, and consequences through a series of readings. By sorting everyday objects and diagramming a simple model of the global carbon cycle, students consider how carbon generally cycles through Earth's systems, including as fossil fuels. This lesson is part of the [Carbon Trackers](#) unit.

## LESSON 2: MODELING THE CARBON CYCLE TO INFORM OTHERS | 4 HRS 35 MINS



In this set of activities, students explore the power of creating visual models in science by first researching then constructing models of the rock cycle, the water cycle, and the processes of photosynthesis and respiration in jigsaw groups. Using these models, students teach other groups about their assigned topic, and then collaborate to integrate this information into a larger model of the global carbon cycle. Finally, an experiment, reading, and video about the greenhouse effect help students consider the role of greenhouse gasses in their model of the global carbon cycle. This lesson is part of the Carbon Trackers unit.

## LESSON 3: EDUCATE OTHERS TO INSPIRE ACTION

1 2 HRS 30 MINS



Students, in their role as scientists, create and finalize a collaborative model of the global carbon cycle. As a class, they use the model in a presentation aimed to inform and inspire an invited audience to think more carefully about the impacts of fossil fuel use. This lesson is part of the Carbon Trackers unit.

## BACKGROUND & VOCABULARY

### Vocabulary

Term	Part of Speech	Definition
atmosphere	<i>noun</i>	layers of gases surrounding a planet or other celestial body.
biosphere	<i>noun</i>	part of the Earth where life exists.
carbon	<i>noun</i>	chemical element with the symbol C, which forms the basis of all known life.
carbon cycle	<i>noun</i>	series of processes in which carbon (C) atoms circulate through Earth's land, ocean, atmosphere, and interior.
carbon emission	<i>noun</i>	carbon compound (such as carbon dioxide) released into the atmosphere, often through human activity such as the burning of fossil fuels such as coal or gas.
coal	<i>noun</i>	dark, solid fossil fuel mined from the earth.
coal seam	<i>noun</i>	coal deposit. Also called a coal bed.

<b>Term</b>	<b>Part of Speech</b>	<b>Definition</b>
<b>combustion</b>	<i>noun</i>	burning, or the process of a substance reacting with oxygen to produce heat and light.
<b>condensation</b>	<i>noun</i>	process by which water vapor becomes liquid.
<b>electromagnetic radiation</b>	<i>noun</i>	energy waves affected by both electricity and magnetic fields; includes radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays.
<b>emission</b>	<i>noun</i>	discharge or release.
<b>energy</b>	<i>noun</i>	capacity to do work.
<b>erosion</b>	<i>noun</i>	act in which earth is worn away, often by water, wind, or ice.
<b>evaporation</b>	<i>noun</i>	process by which liquid water becomes water vapor.
<b>extraction</b>	<i>noun</i>	process by which natural resources are extracted and removed from the earth.
<b>fossil fuel</b>	<i>noun</i>	coal, oil, or natural gas. Fossil fuels formed from the remains of ancient plants and animals.
<b>greenhouse effect</b>	<i>noun</i>	phenomenon where gases allow sunlight to enter Earth's atmosphere but make it difficult for heat to escape.
<b>greenhouse gas</b>	<i>noun</i>	gas in the atmosphere, such as carbon dioxide, methane, water vapor, and ozone, that absorbs solar heat reflected by the surface of the Earth, warming the atmosphere.
<b>hydrologic cycle</b>	<i>noun</i>	system of recycling liquid, gas, and solid water throughout a planet. Also called the water cycle.
<b>hydrosphere</b>	<i>noun</i>	all the Earth's water in the ground, on the surface, and in the air.
<b>lithosphere</b>	<i>noun</i>	outer, solid portion of the Earth. Also called the geosphere.
<b>natural gas</b>	<i>noun</i>	type of fossil fuel made up mostly of the gas methane.
<b>nonrenewable resource</b>	<i>noun</i>	natural resource that exists in a limited supply.
<b>organic</b>	<i>adjective</i>	composed of living or once-living material.
<b>petroleum</b>	<i>noun</i>	fossil fuel formed from the remains of ancient organisms. Also called crude oil.
<b>photosynthesis</b>	<i>noun</i>	process by which plants turn water, sunlight, and carbon dioxide into water, oxygen, and simple sugars.
<b>precipitation</b>	<i>noun</i>	all forms in which water falls to Earth from the atmosphere.
<b>process</b>	<i>noun</i>	continuous action, operation, or series of changes taking place in a defined manner.

<b>Term</b>	<b>Part of Speech</b>	<b>Definition</b>
<b>reservoir</b>	<i>noun</i>	large, concentrated supply or reserve.
<b>respiration</b>	<i>noun</i>	breathing.
<b>rock cycle</b>	<i>noun</i>	processes that explain the relationship between the three rock types: igneous, sedimentary, and metamorphic. Any rock type can become any other.
<b>sedimentation</b>	<i>noun</i>	process of accumulating small solid deposits.
<b>solar energy</b>	<i>noun</i>	radiation from the sun.
<b>sublimation</b>	<i>noun</i>	the process by which snow or ice becomes water vapor without first melting and passing through the liquid phase.
<b>system</b>	<i>noun</i>	collection of items or organisms that are linked and related, functioning as a whole.
<b>thermal energy</b>	<i>noun</i>	heat, measured in joules or calories.
<b>weathering</b>	<i>noun</i>	the breaking down or dissolving of the Earth's surface rocks and minerals.

