Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the National Center for Atmospheric Research
www.eo.ucar.edu

THE CARBON CYCLE GAME

Students play the role of carbon atoms traveling through the carbon cycle to gain understanding of the the varied pathways through the cycle and the relevance of carbon to living and non-living things..

Related Web Pages for Students

- http://eo.ucar.edu/kids/green/cycles6.htm
- http://www.windows2universe.org/earth/Water/co2_cycle.html
- http://www.physicalgeography.net/fundamentals/9r.html

Student Learning Objectives

- Students will learn that carbon cyles indefinitely through the Earth system and where it is found.
- Students will learn that carbon is integral to Earth's various spheres and that it is exchanged and cycles among them.
- Students will learn that all living things are made of carbon and that it is also a part of the ocean, air, rocks and more.

Time

- One or more class periods

Materials

- Copies of game posters on 8.5"x11" sheets of paper
- Copies of game tickets placed at the appropriate center
- Passport, one per student
- Stickers, stamps, or other passport markers
- 1 pencil per student

National Standards

5-8 Content Standard D: Structure of the Earth System
5-8 Content Standard C: Populations and Ecosystems
9-12 Conent Standard C: Interdependence of Organisms
9-12 Content Standard D: Geochemical Cycles

Preparation

1. Post the larger poster signs provided representing various carbon sources and sinks at various stations around the room.
2. Print passport tickets for each carbon source and sink and place them with their corresponding station. The initials at the bottom of each ticket represent the initials of the center to which they belong.
3. Place a unique stamp or sticker at each center with which students will mark their passports when visiting the center.
4. Copy the passport worksheets, one for each student.

Activity

1. Determine what students know and don't know about carbon and the carbon cycle. Discuss the carbon cycle as a class and explain carbon sources and sinks.
2. Place the various carbon stations and each station's tickets in various locations about the room (a larger room is best). Explain that these are places where carbon can be found within the carbon cycle.
3. Tell the students that they each will be playing the role of a carbon atom. They will be given a passpart and start at one of the stations, draw a ticket, and cycle to new places placed on the information on the ticket drawn. They will record the various stations they visit by marketing their travels on their individual passport. Students should write a note on the passport to explain how they went from one station to the next (i.e. decomposition, animal respiration...).
4. Spread the students out among the various stations and have them begin their travels.
5. Discuss these questions and more with your students following the activity:
   - In the real world, does the cycling of carbon stop?
   - Was everyone's journey the same? Why or why not?
   - What might cause an increase or decrease of carbon dioxide in a given location such as in the atmosphere or buried under ground.
   - Carbon dioxide is often referred to as a greenhouse gas. What does that term mean?
   - Where do you think most of the carbon is located on our planet? Look for evidence online to support your opinion.

Related Background Information on the Carbon Cycle and biogeo-chemical cycles in general can be found at the website at the top of the page.

Carbon Cycle Game

POSTERS & PASSPORT

Name: _____

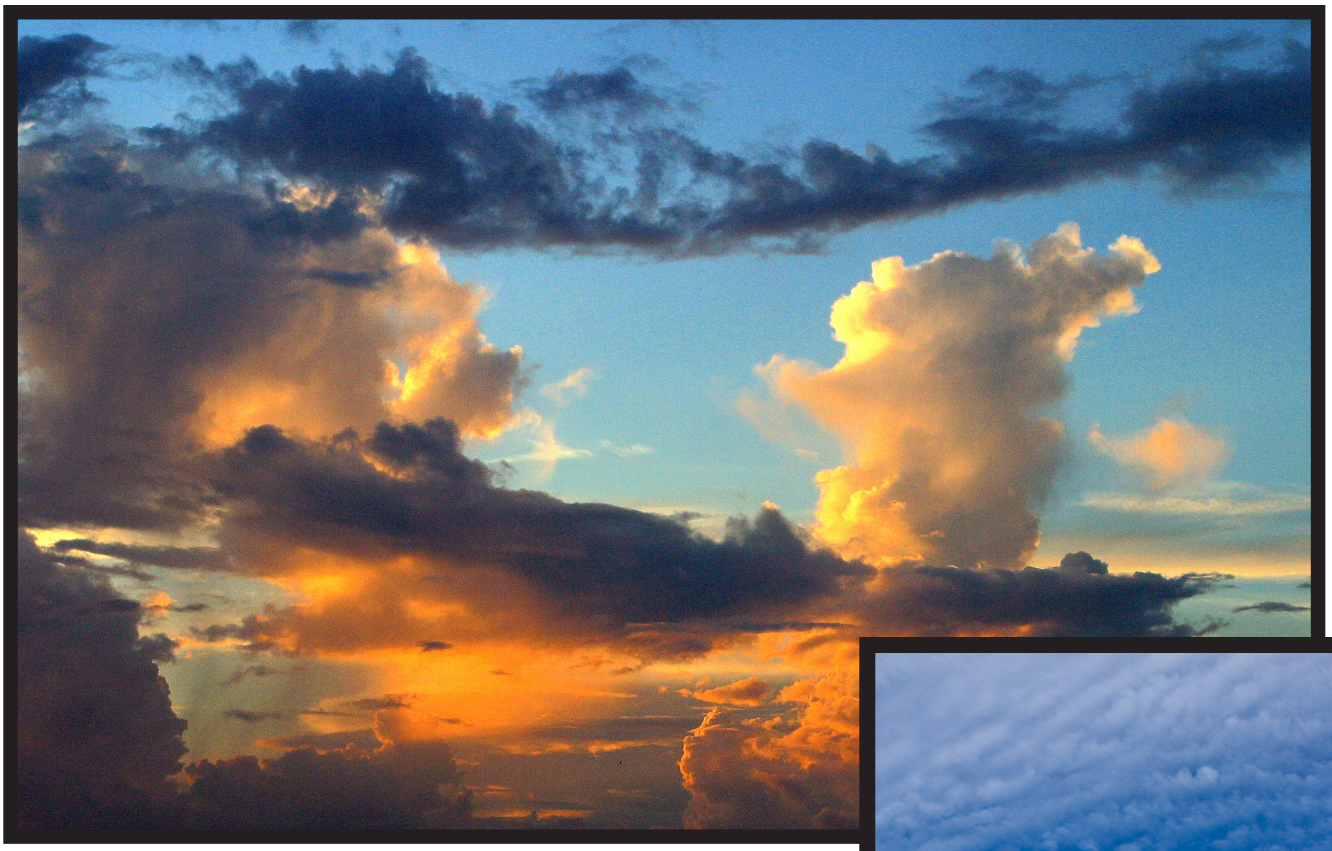
Travel the Forest Ecosystem with your Carbon Passport!

1. *Fill out your start location in the space below.*
2. *Choose from the grab bag at your start location to find out where to go next. Write the "Where I'm going" and "How I'm getting there" information in the Trip #1 box.*
3. *Head to that location and choose from the grab bag to find out where to go next.*

Start Location: _____

Trip 1: Where I'm going:	How I'm getting there:
Trip 2: Where I'm going:	How I'm getting there:
Trip 3: Where I'm going:	How I'm getting there:
Trip 4: Where I'm going:	How I'm getting there:
Trip 5: Where I'm going:	How I'm getting there:

Trip 6: Where I'm going:	How I'm getting there:
Trip 7: Where I'm going:	How I'm getting there:
Trip 8: Where I'm going:	How I'm getting there:
Trip 9: Where I'm going:	How I'm getting there:
Trip 10: Where I'm going:	How I'm getting there:



Atmosphere

Surface Water

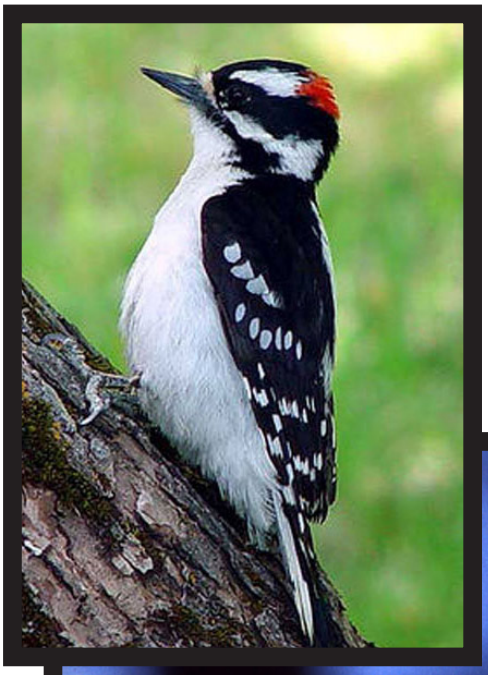
Animal Waste

Soils

Live Animals
Consumers

mountain pine beetle,
porcupine, mule deer

Live Animals
Predators



downy woodpecker,
pine martin,
sharp-shinned hawk,
southern red-backed vole

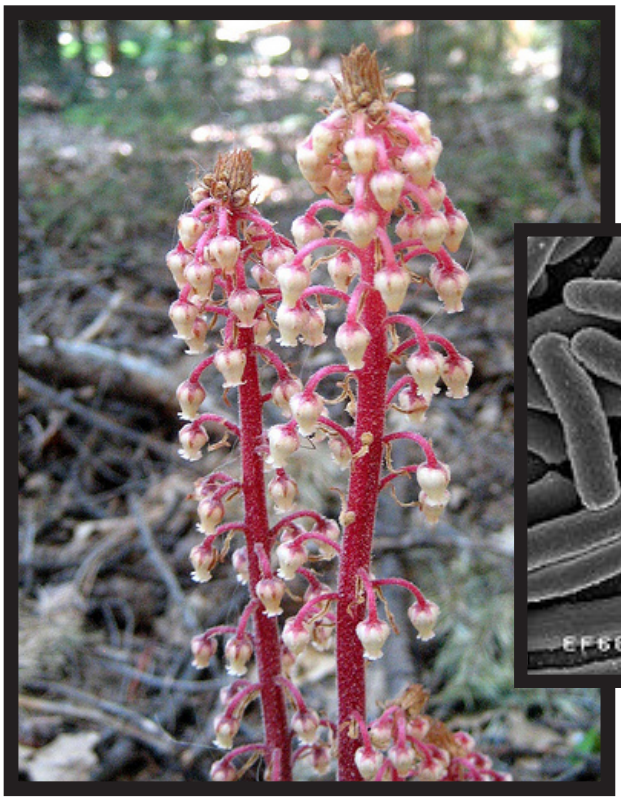
Live Plants

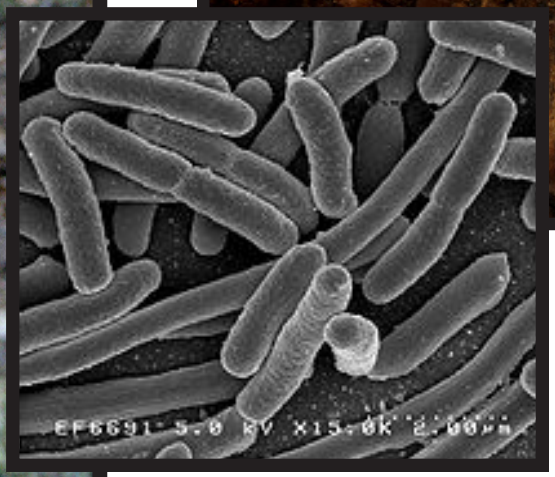
lodgepole pine,
dwarf mistletoe

Dead Plants and Animals

Decomposers & Parasites

Honey Mushroom (right)
Pine Drops (below)
Soil Mcrobes (middle)





Carbon Cycle Game

TICKETS

You are in a dwarf mistletoe plant eaten by a chipmunk. [ingestion]

Go to LIVE ANIMAL CONSUMERS

LP

Wildfire has burned the living tree you are in. [combustion]

Go to the ATMOSPHERE.

LP

You are in a pine tree parasitized by a dwarf mistletoe plant.

Stay in LIVE PLANTS and draw another ticket.

LP

You are in a seed eaten by a white-breasted nuthatch. [ingestion]

Go to LIVE ANIMAL CONSUMERS.

LP

You are in a leaf eaten by a mule deer. [ingestion]

Go to LIVE ANIMAL CONSUMERS.

LP

You are in a pine seed eaten by a chickaree squirrel. [ingestion]

Go to LIVE ANIMAL CONSUMERS.

LP

You move from a pine tree needle to the heartwood where you stay for 80 years.

Stay in LIVING PLANTS
Count to 80 before drawing a new ticket.

LP

You move from a pine tree needle to the bark where you stay for 25 years.

Stay in LIVING PLANTS.
Count to 25 before drawing a new ticket.

LP

During the night, you are released into the air as your pine tree carries on respiration.
[respiration]

Go to the ATMOSPHERE.

LP

You are in the pine tree's bark eaten by a porcupine.
[ingestion]

Go to LIVE ANIMAL CONSUMERS

LP

The tree you are in crashes to the forest floor a year after a pine beetle attack.
[death]

Go to DEAD PLANTS AND ANIMALS

LP

You have been taken out of the air by a dwarf mistletoe plant on a sunny day.
[photosynthesis]

Go to LIVE PLANTS

A

As a part of a greenhouse gas molecule, CO_2, the length of your stay in the atmosphere can be variable.

Stay in the ATMOSPHERE.
You will be here for 10 years, so count to 10 before drawing a new ticket. **A**

As a part of a greenhouse gas molecule, CO_2, the length of your stay in the atmosphere can be variable.

Stay in the ATMOSPHERE.
You will be here for 25 years, so count to 25 before drawing a new ticket. **A**

As a part of a greenhouse gas molecule, CO_2, the length of your stay in the atmosphere can be variable.

Stay in the ATMOSPHERE.
You will be here for 100 years, so count to 100 before drawing a new ticket. **A**

A lodgepole pine tree in the sunshine has removed you from the air to make a sugar molecule.
[photosynthesis]

Go to LIVE PLANTS

A

You have moved from the air into a lake, becoming carbonic acid. [diffusion]

Go to SURFACE WATER

A

You are absorbed by a raindrop as it falls into a stream. [diffusion]

Go to SURFACE WATER

A

You are dissolved in a raindrop which is falling into a pond. [diffusion]

Go to SURFACE WATER

A

You are swept into the air by a breeze passing over a lake. [diffusion]

Go to the ATMOSPHERE

SW

You move into the air that is drifting over a stream on a hot day. [diffusion]

Go to the ATMOSPHERE

SW

You are floating near the surface of a puddle as you are swept into the air. [diffusion]

Go to the ATMOSPHERE.

SW

You are in a puddle at the base of a soggy stump being consumed by a fungus. [decomposition]

Go to DECOMPOSERS

SW

You are in a deer dropping which is consumed by a honey mushroom.
[decomposition]

Go to DECOMPOSERS

AW

You are in a bear poop consumed by a pinedrop plant.
[decomposition]

Go to DECOMPOSERS

AW

You are released into the air by a honey dew mushroom.
[decomposition]

Go to the ATMOSPHERE.

D

You are sent into the air at night in a CO_2 molecule as a coral plant respires.
[respiration]

Go to the ATMOSPHERE

D

You are in a honey mushroom eaten by a black bear.
[ingestion]

Go to LIVE ANIMAL CONSUMERS

D

You are in a honey dew mushroom covered by dew drops that are moving into a puddle.
[decomposition]

Go to SURFACE WATERS

D

You are in a chipmunk eaten by a sharp-shinned hawk.
[ingestion]

Go to LIVE ANIMAL PREDATORS

LAC

You are in the muscle tissue of a chickaree squirrel which is eaten by a pine marten.
[ingestion]

Go to LIVE ANIMAL PREDATORS

LAC

The chipmunk you are within has just died from a viral infection.
[death]

Go to DEAD PLANTS AND ANIMALS

LAC

You are released by a urinating mule deer.
[excretion]

Go to ANIMAL WASTE

LAC

You are in a pine beetle eaten by a woodpecker.
[ingestion]

Go to LIVE ANIMAL PREDATORS

LAC

You are in a bird dropping released as a chickadee flutters by.
[excretion]

Go to ANIMAL WASTE

LAC

You are in a beetle eaten by a southern red-backed vole.
[ingestion]

Go to LIVE ANIMAL PREDATORS.

LAC

You are released as CO_2 into the air from the lungs of a red-backed vole.
[respiration]

Go to the ATMOSPHERE

LAP

You are swept away by stream water flowing past a feeding honey dew mushroom.
[decomposition]

Go to SURFACE WATER

LAP

The sharp shinned hawk you are within has died of old age.
[death]

Go to DEAD PLANTS AND ANIMALS

LAP

You are released as a CO_2 molecule by a growling black bear.
[respiration]

Go to the ATMOPSHERE

LAP

You are in a fat cell inside a downy woodpecker eaten by a sharp-shinned hawk.
[ingestion]

Stay with LIVE ANIMAL PREDATORS and draw another ticket. **LAP**

You are in a pine marten which is killed in a fall from a very tall tree.
[death]

Go to DEAD PLANTS AND AMIMALS

LAP

You have just been pooped out in a dropping by a soaring sharp-shinned hawk.
[excretion]

Go to ANIMAL WASTE

LAP

FIRE! The dead tree you are in is burned in a campfire.
[combustion]

Go to the ATMOSPHERE

DPA

You are in a dead pine needle decomposed by a spotted coralroot plant.
[decomposition]

Go to DECOMPOSERS

DPA

Fire! The dead tree you are in is chopped up and burned by a human to stay warm. [combustion]

Go to the ATMOSPHERE.

DPA

You are in a dead pinecone scale on the ground being decomposed by a pine drop plant.
[decomposition]

Go to DECOMPOSERS

DPA

You are in a dead pine seed eaten by a chickaree squirrel.
[ingestion]

Go to LIVE ANIMAL CONSUMERS

DPA

You are in rotten wood in the forest soil consumed by bacteria.
[decomposition]

Go to DECOMPOSERS

DPA

You are taken up from buried dead wood consumed by a coral root plant.
[decomposition]

Go to DECOMPOSERS

DPA

You are mistakenly swallowed by a southern red-backed vole which is looking for insects in the soil.
[ingestion]

Go to LIVE ANIMAL PREDATORS

S

You are taken in by a fungus feeding in the soil.
[decomposition]

Go to DECOMPOSERS

S

You are released into the air by a coral root plant growing in rich soil.
[decomposition]

Go to the ATMOSPHERE

S