

CLIMATE CHANGE IS IN THE AIR

FOR PARKS AND FOR THE PLANET

The National Park Service has been around for a long time. In fact, 2016 is the agency's 100th birthday. But a century is hardly any time at all when compared to the age of the Earth, which is 4.6 billion years old. Our parks preserve special parts of the natural world, billions of years in the making, for the enjoyment of people today and in future generations.

For parks and people, this moment in history is crucial, because the climate is changing at an accelerated rate due to air pollution from human activities. Flip this poster over to learn about how we know this, what is happening in parks, and what you can do to help.



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“Weather” describes day-to-day conditions of the atmosphere, such as temperature, precipitation, humidity, and winds. “Climate” is the average of these weather conditions over long periods of time. Climate change describes overall trends; it does not predict the exact rate at which temperatures will rise or mean that there will never be localized cold snaps. One cold winter does not by itself change the climate.

Climate scientists tell us that as part of climate change some areas can expect more severe storms along with more flooding, more drought, and extended heat waves. Both climate change and extreme weather events are concerns for national parks.

WHAT'S IN THE AIR UP THERE?

Human activities such as burning fossil fuels for power and transportation, as well as other industrial, commercial, and agricultural processes, create air pollutants. These pollutants can make it difficult for people to breathe, see distant views, and enjoy nature. In addition, some air pollutants, called greenhouse gases, are rapidly warming the planet.

When sunlight reaches Earth, some of the heat reflects

from light-colored surfaces like snow or ice caps and radiates back into space. Greenhouse gases trap the rest of the incoming heat in the atmosphere, warming our planet. Trapping some heat is natural and essential to keeping our planet at a temperature that maintains the natural balance of life. However, greenhouse gas air pollution creates too much of a good thing by trapping more and more heat in the atmosphere, unnaturally raising global temperatures.



Carbon dioxide (CO₂) is the most common greenhouse gas. Electricity and transportation are responsible for over two-thirds of all human-created carbon dioxide.



WHAT ARE NATIONAL PARKS DOING?

National parks are doing their part to reduce air pollution, including greenhouse gases, by investing in alternative energy and increasing efficiencies in transportation, electrical power, and recycling.

Because most pollution in national parks comes from outside park boundaries, the National Park Service partners with air regulators, developers, industry, agricultural producers, and other stakeholders to reduce air pollution. This can help both slow climate change and benefit clean air and clear views for parks and nearby communities.

LEARN MORE!

NPS Air Resources: www.nature.nps.gov/air
NPS Climate Change:

www.nps.gov/subjects/climatechange/index.htm



Methane (CH₄) is released primarily (60 percent) from natural gas and oil production, as well as natural gas production from livestock: burps and farts. Methane is 25 times more powerful than carbon dioxide for warming the planet.



WHAT CAN YOU DO?

Take actions that will have multiple benefits. For example, taking a bike ride instead of driving your car helps reduce greenhouse gases. Whenever you use gasoline in a car, or natural gas and electricity for heating, cooling, and light, you contribute to air pollution. Save energy, reduce waste, and save money.

- **Drive less.** Combine trips, carpool, ride your bike, or take the bus or park shuttle.
- **Reduce power.** Use CFL or LED light bulbs, and turn things off when not in use.
- **Get comfortable.** Insulate your home and use a programmable thermostat to reduce energy used for heating and cooling.
- **Be “food smart.”** Support local agriculture, understand the environmental impacts of food choices, and waste less food.
- **Reduce, reuse, recycle.** It takes energy to make and sell the products we use.



Nitrous oxide (N₂O) is commonly released from agricultural fields when fertilizer is added and from automobiles through fuel combustion. N₂O has 300 times the global warming impact of carbon dioxide because it stays in the atmosphere for over 100 years.

HOW DO WE KNOW?



Scientists know Earth’s climate has changed over time. Scientists also see clear evidence that greenhouse gas concentrations are higher than they have ever been in human history, and that humans are now changing Earth’s climate at a faster rate than our species has ever experienced. But how do we know what climate was like before humans were around to measure and record it? Scientists study global climate over long time periods using air bubbles in ice cores, tree rings, fossils, and other indirect (proxy) evidence.

PARK SCIENCE: ICE CORES

As glaciers form, bubbles of air are trapped in the ice, preserving



samples of ancient air. By measuring greenhouse gas concentrations in bubbles from different ice layers, scientists learn how the concentrations changed over time.

Glacial ice at Mount Hunter in Denali National Park and Preserve (Alaska) is more than 700 feet thick and could contain air bubbles more than 4,800 years old. Polar ice caps are much thicker, with ancient air records up to 800,000 years old (Antarctica).

PARK SCIENCE: TREE RINGS

The thickness of each tree ring represents how much growth occurred in a tree during a year. Temperature, water availability,



insects, and natural disasters can affect tree ring thickness.

Bristlecone pine trees in Great Basin National Park (Nevada) are some of the oldest trees on Earth, up to almost 5,000 years old. That’s a lot of tree rings!

PARK SCIENCE: FOSSILS

Fossils show what animals or plants lived in an area long ago.

Fossil palm trees and fish in Fossil Butte National Monument (Wyoming) show that, 52 million years ago, southwest Wyoming (which is now cold and dry) had a much warmer, and wetter climate—much like Florida today.

WHAT IS HAPPENING?



Life can generally cope well with gradual change. However, in the past few decades scientists have observed changes in greenhouse gas levels and temperature that would normally occur over tens of thousands to millions of years. These “super fast” changes challenge the ability of living things—plants, animals, and humans—to adapt and ultimately survive rapidly shifting environmental conditions.

So far, the most dramatic evidence of a changing climate has been seen in parks closest to the north and south poles, along beaches, and high in the mountains. Many fragile ecosystems and cultural resources in these places are in danger of disappearing forever.

For example:

- The alpine glaciers in Montana’s Glacier National Park are disappearing. In 1850, there were 150 glaciers in the park, but now only 26 are left. Scientists predict that these glaciers will be completely gone by 2030.

- Plants like Joshua trees, for which Joshua Tree National Park in California was named, can survive only in a narrow temperature zone. If current trends of changing temperatures continue, one day there may be no Joshua trees in Joshua Tree National Park.

- Along the coast of Everglades National Park, rising sea level and extreme weather events are quickly eroding archeological sites left behind by some of Florida’s earliest cultures.

- As grizzly bears in Yellowstone National Park fatten up for winter, they rely on nutrient-rich whitebark pine seeds. However, bark beetles which can survive warmer winters are killing whitebark pines across North America and reducing this critical food source. This lowers the grizzlies’ survival rates and can increase bear-human conflicts as bears search for alternate foods.

Learning Activity Making a Gas!

Carbon dioxide (CO₂) is the most common greenhouse gas. Burning fossil fuels for electricity and transportation generates over two-thirds of all human-created carbon dioxide. Chemical reactions can also form and release greenhouse gases into the atmosphere. You can create carbon dioxide gas by following the steps in this learning activity.

MATERIALS

- Balloon
- Funnel
- Measuring spoons
- Measuring cups
- Empty bottle (1 liter size or smaller)
- Baking soda
- Vinegar

STEPS

1. Use the funnel to pour 2 teaspoons of baking soda into an empty balloon. Rinse and dry the funnel.
2. Use the funnel to pour one-fourth cup of vinegar into the bottle.
3. Stretch the mouth of the balloon around the bottle top.
4. Lift the balloon, letting the baking soda pour into the bottle. Watch what happens!

SUMMARY

When you combine baking soda and vinegar, the chemical reaction creates carbon dioxide gas. Carbon dioxide, like many other air pollutants, is invisible. The bubbles that form when the vinegar and baking soda mixture begin to fizz and the inflating balloon are evidence of the chemical reaction you have created!

ACTIONS MAKE A DIFFERENCE!

Back in the 1970s, air pollution in the United States was much worse than it is today. Some said that it would never get better, and that the price of progress was dirty air.

But environmental laws and new technology have helped reduce air pollution, making the air cleaner and healthier now than it used to be, even though there are more people. This shows us that we can tackle difficult problems like climate change by working together for a better and cleaner future.

Project: NPS Air Resources Division (Melanie V. Peters, Ksienya Taylor, Mike Bell, Tamara Blett, Jim Heatham, Susan Johnson, Kristi Morris); NPS Climate Change Response Program (Larry Perez); NPS Geologic Resources Division (Jason Kenworthy); AGI (Geoff Camphire); DESIGN: Angela Terry Design. Photos courtesy National Park Service. FRONT clockwise from left: Great Basin NP; Denali NP & PRES; Death Valley NP (Drew Kaiser); Chattahoochee River NRA; Congaree NP (i-fineart.com); Bandelier NM; Arches NP; Fossil Butte NM; Cape Hatteras NS, Denali NP & PRES; Natural Bridges NM (Andrew Kuhn); North Cascades NP; Denali NP & PRES; Buffalo NR; Glacier Bay NP & PRES (Allison Banks); Indiana Dunes NI; Chickasaw NRA; BACK clockwise from left: Shenandoah NP; Wind Cave NP; Denali NP & PRES (Mike Waszkiewicz); Great Basin NP; Fossil Butte NM; Glacier NP; Joshua Tree NP; Everglades NP; Lake Clark NP & PRES (K. Jalone).