CALIFORNIA
AIR RESOURCES BOARD

Frequently Asked Questions: Wildfire Emissions

Fire is part of Earth's carbon cycle; combustion of fossil fuels is not.

Do wildfires contribute to climate change?

Yes. Wildfires release carbon dioxide (CO_2) emissions and other greenhouse gases (GHG) that contribute to climate change. It is challenging to determine how much wildfire emissions alter the GHG concentrations in the atmosphere and contribute to anthropogenic climate change because wildfire emissions are part of the terrestrial carbon cycle. Wildfires, when they occur in a healthy way, can also bolster sequestration rates and help preserve carbon stocks by germinating seeds, mobilizing nutrients, thinning overly dense forests, and reducing risk of catastrophic wildfire.

Why does California's Air Resources Board (CARB) focus on reducing GHG emissions from transportation and other sources when wildfires keep happening across the State?

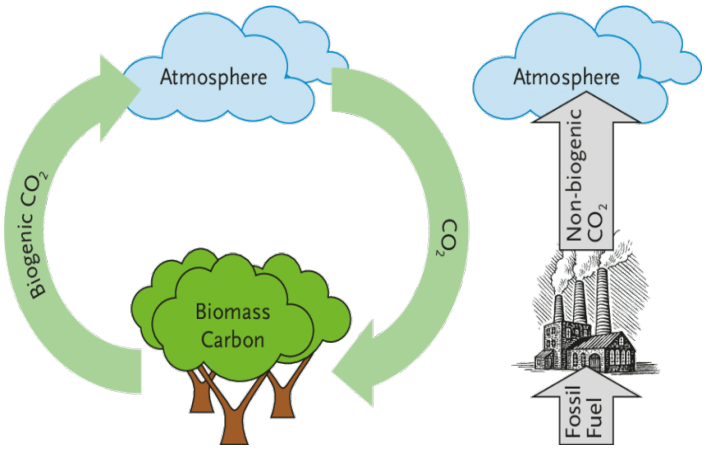
Since the passage of the California Global Warming Solutions Act (Assembly Bill 32, or AB 32), CARB has focused on reducing fossil fuel combustion emissions and other anthropogenic emissions because they are accumulating in the atmosphere at an unprecedented pace. Fossil fuel combustion releases ancient carbon stored underground for millions of years that the atmosphere has not seen in recent carbon cycle.

Earth's carbon cycle transfers carbon between the land, ocean, and atmosphere. As part of the carbon cycle, fire, plant respiration and decomposition are balanced by plant growth and other processes that take place over decades or centuries. When in balance, these biogenic CO_2 emissions from fire and other sources are balanced by CO_2 sequestration in natural and working lands and waters, resulting in relatively minimal change in the total concentration of atmospheric CO_2 that drives climate change. Emissions from fossil-fuel combustion are contributing to putting this cycle out of balance. They are also contributing to a feedback loop for California's forests and lands: as CO_2 emissions accumulate in the atmosphere and California experiences more warming, extreme heat events, and droughts, the risk and intensity of fires also increases, which in turn push the terrestrial carbon cycle further out of balance.

Because of this effect, CARB works to understand and track both the total GHG emissions from anthropogenic sources, like the combustion of fossil fuels, and the total carbon flux (or net change in carbon on the landscape) from terrestrial carbon.

Further, climate change is primarily driven by fossil fuel emissions, and climate change is one of the primary drivers of the increased catastrophic wildfire we are experiencing in California today. Hotter and drier weather, caused by climate change, is making catastrophic wildfire more likely and more severe. Therefore, one of the best ways of decreasing the probability and severity of catastrophic wildfire is to fight climate change itself, and the most effective way to fight climate change is to reduce fossil fuel emissions.

Figure 1. Carbon Cycle vs. Fossil Fuel Combustion



Source: National Council for Air and Stream Improvement

Does CARB track GHG emissions from wildfires?

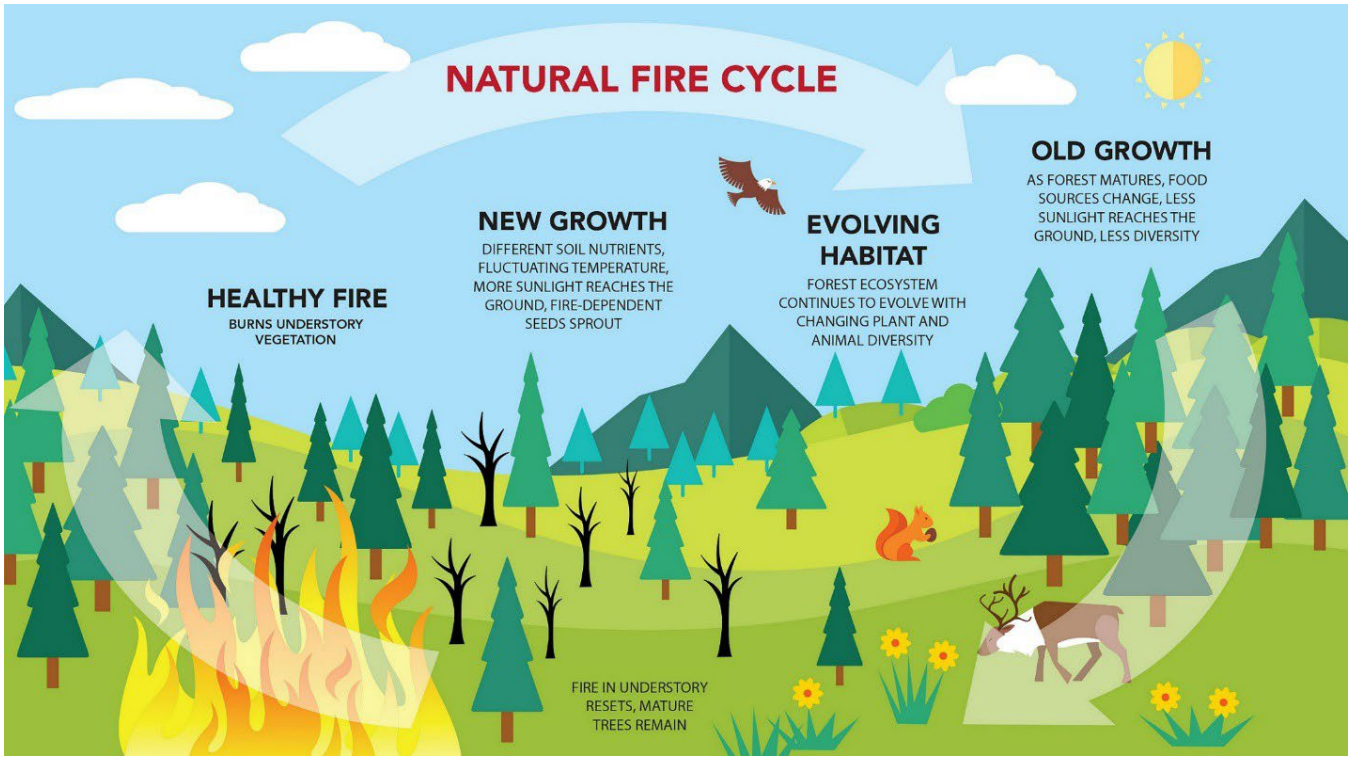
Yes. CARB estimates GHG and criteria pollutant emissions from wildfires. CARB also works with other State agencies to develop an ecosystem carbon inventory for natural and working lands. *This inventory quantifies the carbon stored in the State's forests, soils, and other natural lands*. Looking year-over-year at the data in the inventory, we can see clear trends of carbon loss in California's natural and working lands, with most of those losses coming from wildfires.

In recent years, the intensity and size of wildfires have increased across California. In an effort to contextualize the GHG emissions from wildfires, CARB annually publishes wildfire emissions estimates on its *program webpage* using fire footprint information from the California Department of Forestry and Fire Protection (CAL FIRE). CARB's fire emission modeling results indicate that wildfires transferred an average of 15 million metric tons of CO_2 ($MMTCO_2$) per year from plants into the atmosphere during 2000-2019. When including 2020 and 2021, the annual average is 22 $MMTCO_2$ per year. To put things into perspective, 22 $MMTCO_2$ is equivalent to the amount of carbon contained in the structural lumber of 1.2 million average California single-family homes, or about 15 percent of all single-family homes in California.

Should it be our goal to eliminate all wildfires in the State?

No. Fire is a natural and critical ecological function for maintaining healthy and resilient forests, and supports several ecosystem functions such as facilitating germination of seeds, replenishing soil nutrients, stimulating tree growth, and reducing fuels.

Figure 2. Natural Fire Cycle



Source: www.openspaceauthority.org

AB 32 requires CARB to develop a Scoping Plan to reduce GHG emissions in California. If wildfires are a source of GHG emissions, will CARB include wildfire emissions in the upcoming Scoping Plan?

Previously, CARB has focused on limiting emissions from the burning of fossil fuels and limiting the release of Short-Lived Climate Pollutants like methane and hydrofluorocarbons. CARB is now turning its attention towards achieving carbon neutrality, which means balancing all sources of GHG emissions with carbon sinks by mid-century.

In 2018, the *Intergovernmental Panel on Climate Change (IPCC) issued a Special Report* that made itclear that limiting climate change to 1.5 degrees Celsius would require global carbon

neutrality by 2045, and that carbon neutrality must include the sources and sinks of emissions from all sectors, including natural and working lands.

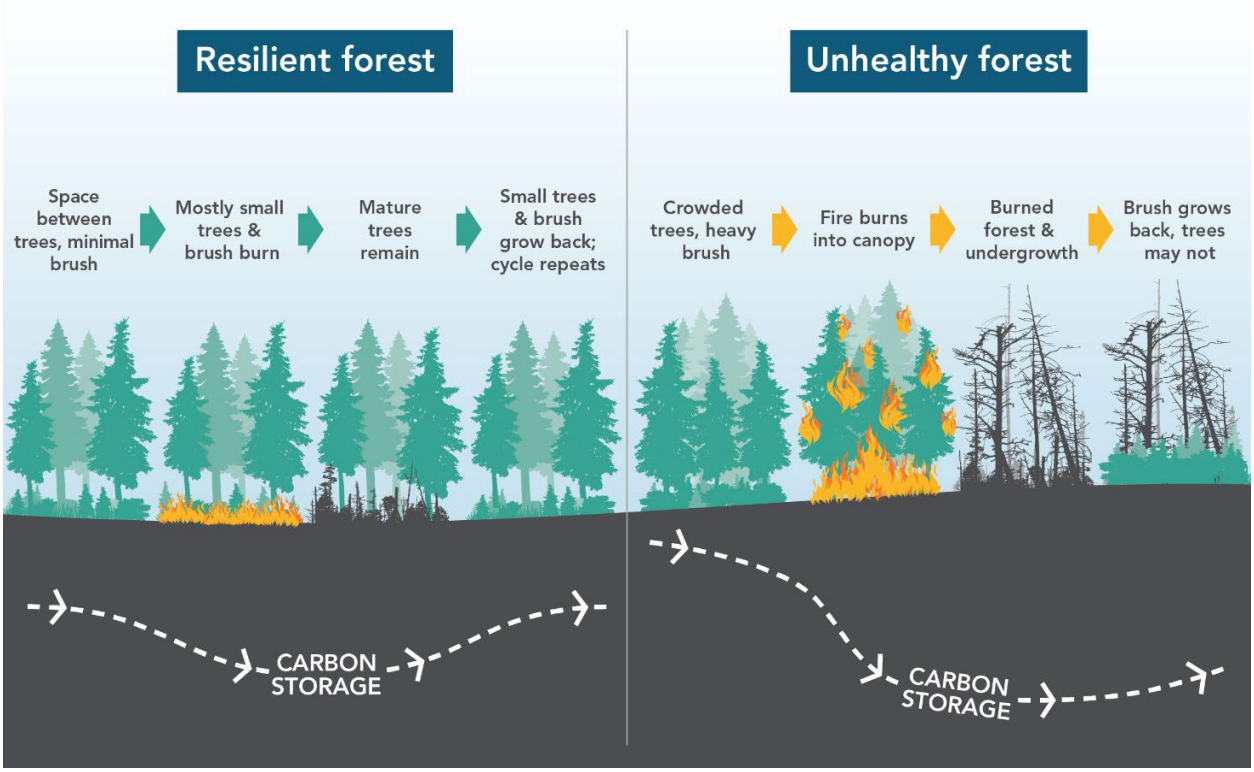
Use of fossil fuels created the climate and air quality problems we face, so our first priority will continue to be to minimize combustion of fossil fuels and reduce emissions as much as possible. This will not just reduce future global warming, but will also provide air quality and public health improvements for Californians, particularly those living in areas of high pollution exposure near traffic or other industrial sources. We also expect that California will need to develop and utilize carbon sinks via engineered carbon removal and natural and working lands to achieve carbon neutrality. Recent catastrophic wildfires, land conversion, and other disturbances that are largely driven by climate change and human activity, have turned our natural and working lands into a net source of emissions[1], which makes achieving carbon neutrality even more challenging. As part of the upcoming Scoping Plan effort, CARB will work to project the net flux (or change) of carbon on the State's natural and working lands between now and mid-century. This flux will include both changes in carbon sequestration as well as emissions from wildfires and otherdisturbances.

What is the goal for natural and working lands in the upcoming Scoping Plan?

California state agencies are working together to better understand the natural and working lands carbon flux in a changing climate, how best to stabilize carbon in California's ecosystems, and approaches to setting targets for natural and working lands in support of carbon neutrality, consistent with the Governor's Executive Order N-82-20.

Achieving maximum carbon sequestration in natural and working lands will not be the objective for this work or for the Scoping Plan, because overstocked forests with high carbon sequestration can lead to future catastrophic wildfires, disease, pests, and ecosystem imbalances. The 2022 Scoping Plan will instead focus on what is needed for forests and other natural and working lands to be more resilient and healthy and to continue to provide water, air and biodiversity benefits to California, in addition to supporting carbon neutrality for the State.

Figure 3. Resilient Forests



What is CARB currently doing to address air pollution and GHG emissions from wildfires?

- CARB supports air districts in monitoring smoke from wildfires, including particulate matter, which is the pollutant from wildfires primarily responsible for the poor air quality occurring from fires across California and the West Coast. California has a network of over 250 permanent air monitoring stations, operated by federal, State, and local agencies, as well as a number of portable monitors that can be deployed as part of the incident air monitoring program. This monitoring data is used in many of the air quality reporting services, like AirNow, that people are using to understand their local air quality and the real-time impacts from wildfires.
- CARB initiates research on the effects of wildfire on California, specifically focused on improving our understanding of the air pollution components, regional/local air quality impacts, health impacts, and other effects of wildfires.
- CARB works with other state agencies on strategies to reduce wildfire emissions. The California Natural Resources Agency (CNRA), and its boards and departments, is the State agency primarilyresponsible for taking actions to reduce wildfire risk and severity. CARB staff work closely with CNRA in a number of ways:
    - Through our California Climate Investments (CCI) program, we work with CNRA to identify forest management strategies that improve forest health, lead to

long-term carbon sequestration, and reduce the risk of wildfire. We work with CNRA to assess the GHG benefits from these actions. Some of the projects funded through the CCI program include land conservation and management, fuels reduction, prescribed fire, advanced technology biomass utilization, support for alternative wood products from forest residue, and others.
    - Through policy and technical coordination on forest carbon accounting.
    - By working with air districts and land managers to increase opportunities for prescribed fire, which is an important forest management tool.
    - By supporting and encouraging prescribed burning across the state when meteorological conditions are conducive to burning with minimal impact on air quality to mitigate the effects of wildfire.
    - Through collaboration in developing inventories and modeling capabilities to better understand current and future wildfire impacts and emissions for scientific and policy development needs.

What are some of the health and environmental impacts of wildfires (in terms of air pollution and GHG emissions)?

Health:

CARB is still continuing to enhance our knowledge of the health impacts from wildfires by deploying our laboratory, research, and monitoring teams to study and assess these effects. Through this work and previous research, it is clear that:

- Wildfires produce harmful complex mixtures of air pollutants, including particulate matter, toxic air contaminants, and carbon monoxide (CO).
- Smoke from structural fires, such as residential, commercial, and industrial fires, can contain dangerous toxins, including metals, CO, hydrogen cyanide and toxic volatile organic compounds.
- Smoke particles in soot, ash and dust can build up in our bodies and cause a number of immediate health problems even in healthy individuals, including burning eyes, runny noses, scratchy throat, irritated sinuses, and headaches. Wood smoke can cause lung irritation leading to cough and shortness of breath and the effects can be seen even after the smoke clears, although healthy people will recover more quickly.
- Research shows a strong association between exposure to small particulate matter ($PM_{2.5}$) from wildfire smoke and increasing severity of asthma, other respiratory disease, such as Chronic Obstructive Pulmonary Disease (COPD), inflammation or infections, including bronchitis and pneumonia, emergency department visits, and hospital admissions.
- Long-term exposure to $PM_{2.5}$ is linked to a wide range of human health effects, such as respiratory and heart related illnesses and hospitalizations, adverse brain effects, depression, memory loss, learning disorders, reduced lung function growth in children, and premature death. Often these effects can be seen days after the smoke exposure.

GHG:

- California's forests cover about 1/3 of the State. Approximately 85 percent of terrestrial carbon is stored in forests and shrublands.
- According to CARB's NWL inventory, approx. 140 million metric tons (MMT) of carbon was transformed by various human activities and natural processes between 2001 and 2014. Not all of this carbon has been released to the atmosphere. Some of this carbon remains on the landscape in the form of dead vegetation; some persists in the form of logs, lumber, buildings, furniture, or other products; and some remains in landfills as non-decomposable carbon. This is *equivalent* to 510 MMT of CO_2 that was previously sequestered in California's lands as part of the terrestrial carbon cycle. As California seeks to address changing wildfire regimes, the severity of carbon losses from wildfires will have implications for ecosystems, biodiversity, the economy, public health, and more.