TeachEngineering

Wildfire and Car CO2 Emissions Student Workbook – Answer Key

Wildfires and Cars KEY

Do they release CO_2?

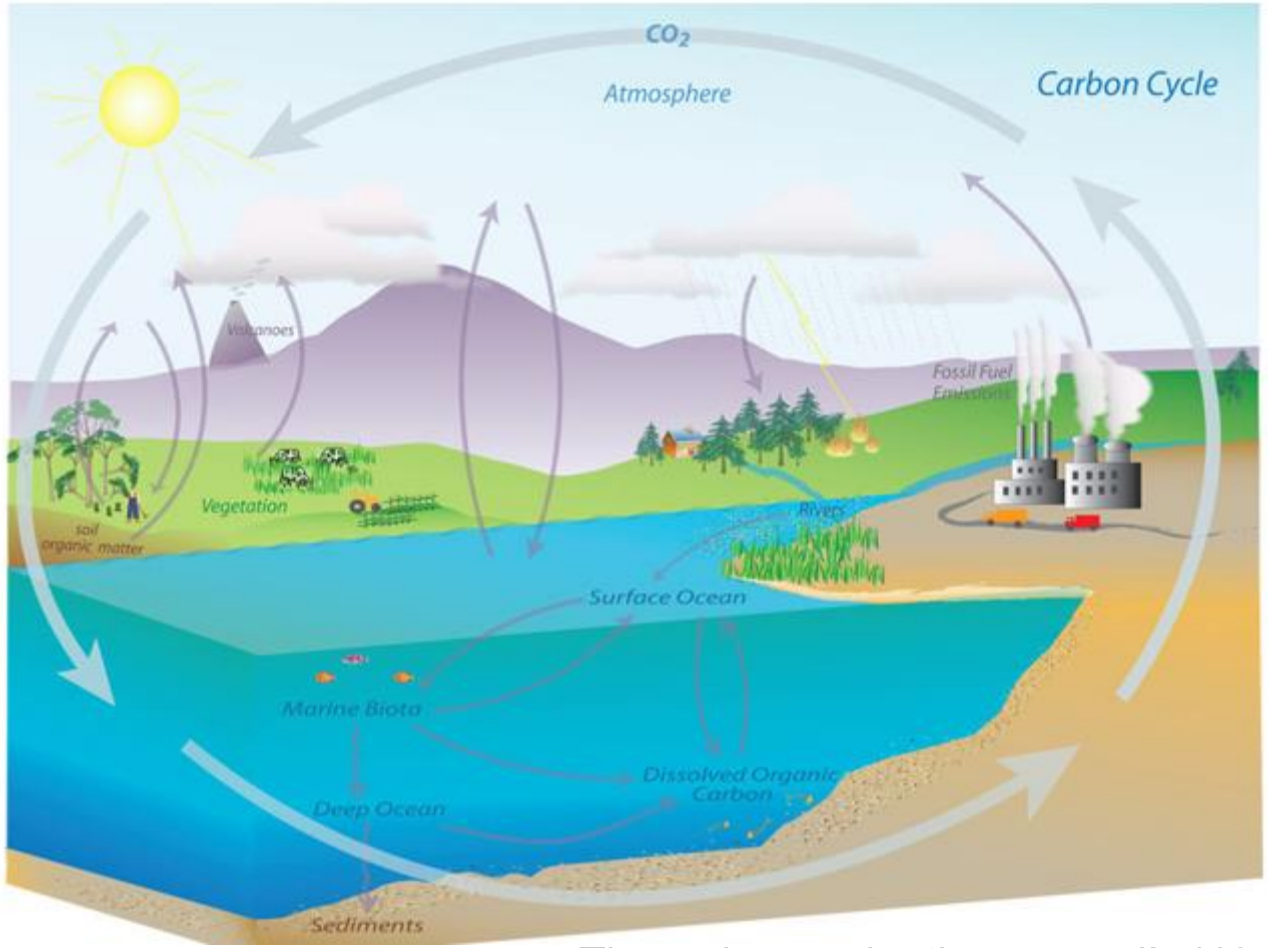
Is one worse than the other?

https://en.wikipedia.org/wiki/Wildfire#/media/File:The_Rim_Fire_in_the_Stanislaus_National_Forest_near_in_California_began_on_Aug._17,_2013-0004.jpg
https://www.frost.com/frost-perspectives/eu-sets-100-reduction-target-in-vehicle-co2-emissions

Carbon Cycle Review

- Using the diagram, list how CO_2 is released and absorbed in a cycle.

CO_2 Released	CO_2 Absorbed (Sink)
Burning fossil fuels Driving cars Driving tractors Mining/agriculture that releases CO_2 in the soil Forest fires Volcanoes erupting Respiration (exhale CO_2) Cows chewing cud, release CH_4 that converts to CO_2	COLD ocean water Death/decomposition Plants (absorb CO_2 and release O_2)

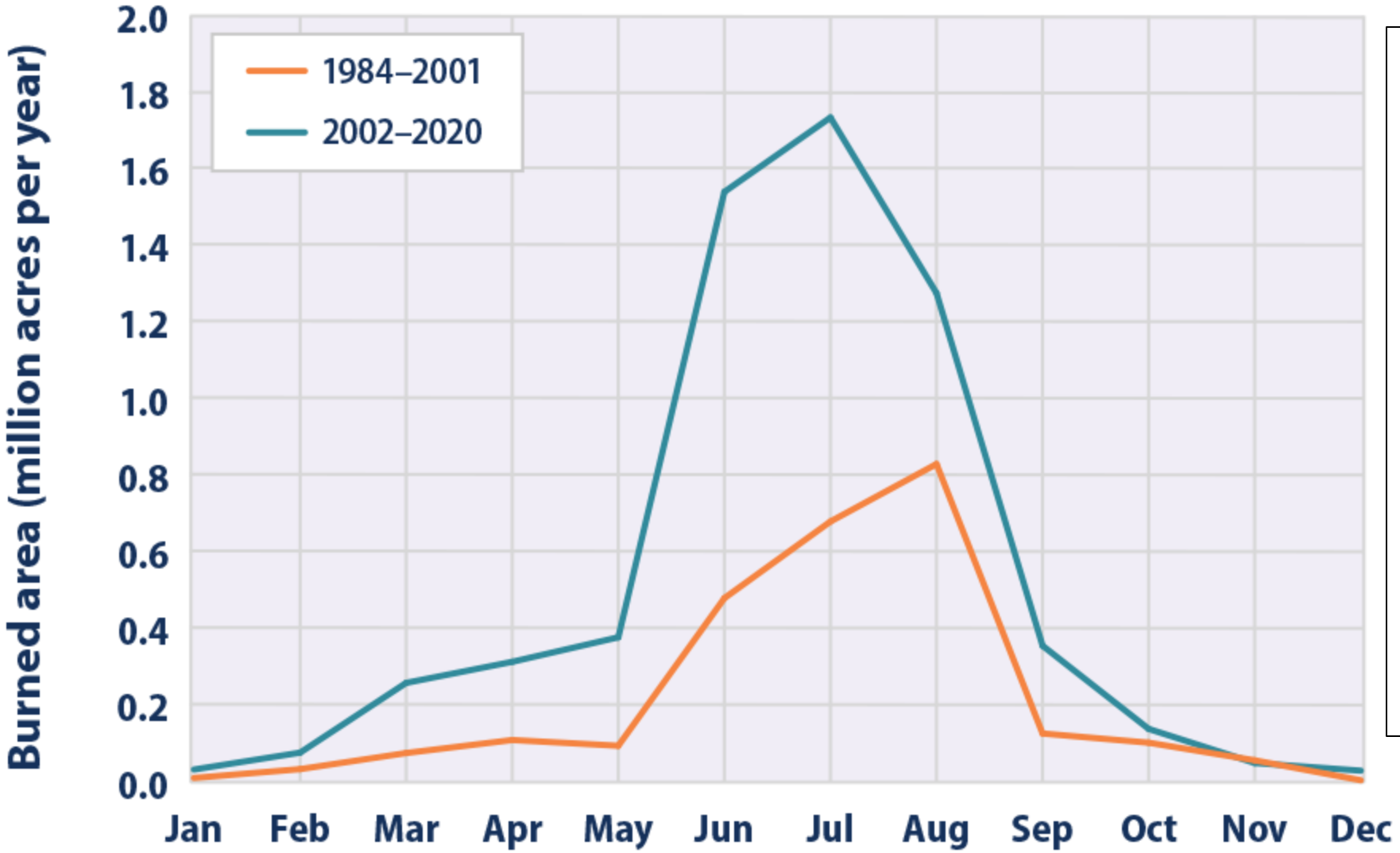


The carbon cycle. (Image credit: NOAA)

Why is the cycle out of balance? What is the result of an imbalanced cycle?

From the list, we can see that the cycle is releasing much more CO_2 than it is absorbing. As more CO_2 is released into the atmosphere, it is causing climate change, with warmer temps, warmer ocean water, droughts AND big storms, stronger hurricanes, and more forest fires.

Comparison of Monthly Burned Area Due to Wildfires in the US between 1984-2001 and 2002- 2020



Turn and Talk: Write two conclusions from the graph.

The graph shows that there is more area burned in 2002-2020 than there was from 1984-2001.

It also shows that the forest fire season in 2002-2020 is longer. It is starting earlier, with an increase in fires in February, as compared to May in the 1984-2001 line.

Data Source: EPA website, MTBS (Monitoring Trends in Burn Severity), 2022

Fire Management

- Not every fire is a wildfire. How is this diagram demonstrating a healthy forest?

- Forest fires are necessary to burn the underbrush. It encourages new growth from fire-dependent seeds, and more nutritious soil. Fires help forests maintain their biodiversity.
- Healthy fires do not destroy trees. They may have a burn scar, but it will not always kill the tree.

Source: www.openspaceauthority.org

Forest Management: The Story of the 1988 Yellowstone Fire

- Answer the questions while watching the video: https://www.youtube.com/watch?v=CAgP9fo3f7s

1. Why did park officials originally just let the fires burn in Yellowstone?

   Since 1972, fires would just burn out from years of data.

2. On July 21, 1988, what did park officials decide to do about the fire?

   The fires kept burning and they were getting out of control.

3. What was a result of the hugely popular Smokey the Bear campaign?

   Tons of underbrush built up, setting the stage for huge fires, then in 1988, it was dry and windy.

4. What finally put out the fires?

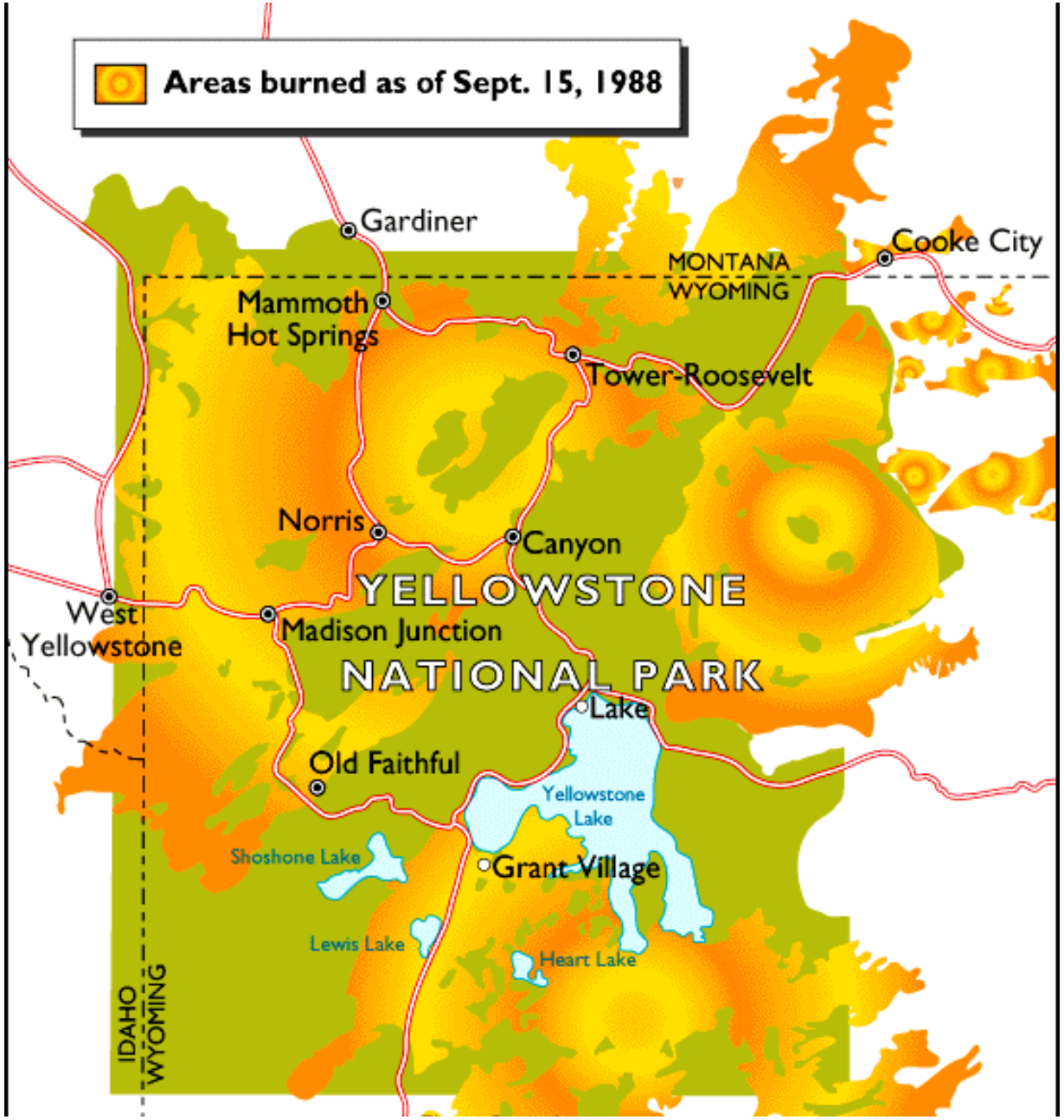
   A quarter inch of snow!

5. After the fires, how did the park change?

   Plants began to grow, bison were having babies, lodgepole pines require fire to open the cones for new trees to grow, but can be a slow process, taking 200-300 years for the lodgepole pines to grow to full height.

6. Why is letting some fires burn no longer an option in some places?

   There are many populated areas, so saving people and homes that are threatened by fire is imperative.



Secondary succession in action!

Climate Change and Fire (Positive Feedback)

- How does changing the climate impacting wildfires?

When trees burn,
what do they release?
CO2

More _CO2_____ in the atmosphere

Which does what to the temperature?
Temps rise

Which the leads to what type of weather conditions?
Drier/drought conditions

If there are more droughts, there will be more __FIRES__

Wildfire Evacuation

Stop at 7:43 https://www.youtube.com/watch?v=Y9r4hlk1_Zg
60 Minutes Rewind--Paradise Lost: Inside California's Camp Fire, 60 Minutes' 2018 report

1. Write five observations about the mass evacuation.

- It was very chaotic. People didn't know where to go, traffic jams as people tried to evacuate.
- Fire is everywhere, moving very fast. An inferno.
- It killed 90 people and destroyed 19,000 buildings, businesses, and homes in just a few hours.
- It was dark; the smoke blocked the sun.
- Some people gave up and tried to walk out, but there wasn't anywhere to go until a firefighter picked them up.
- Firefighters kept going back into the fire to save people.

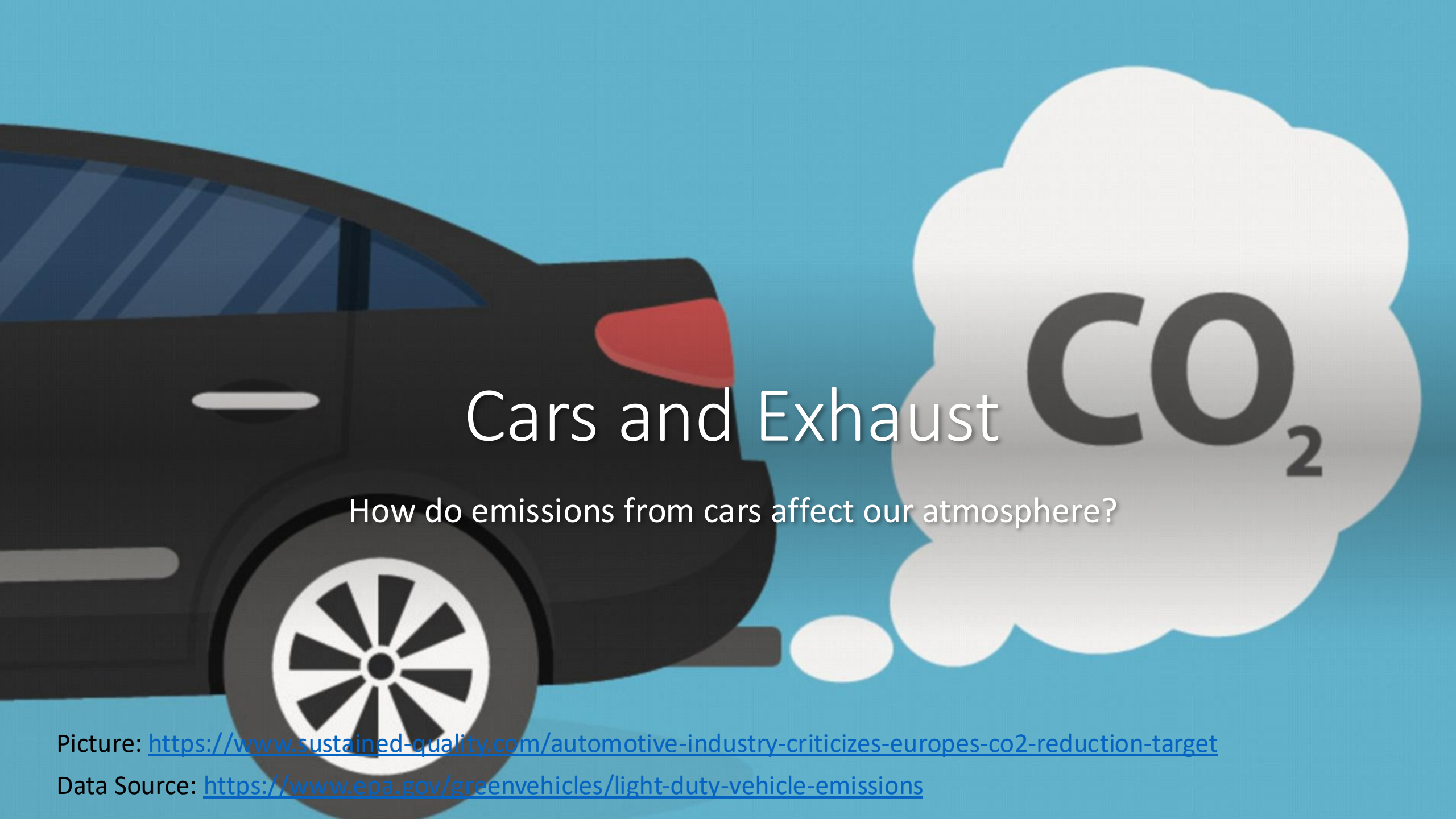
2. How did the fire start?

- Campfire

3. What factors made the Paradise fire and extreme wildfire in California?

- 40 mph winds from the north, growing an acre (one football field) every second
- 5 years of drought
- Vegetation is very dry
- Temperatures are increasing

4. How many acres were consumed in 12 hours? 153,300 acres



Cars and Exhaust

How do emissions from cars affect our atmosphere?

Picture: https://www.sustained-quality.com/automotive-industry-criticizes-europes-co2-reduction-target

Data Source: https://www.epa.gov/greenvehicles/light-duty-vehicle-emissions

TWO types of gases released from cars

Greenhouse gas (GHG) emissions

- CO_2, 99% of the GHG released from tailpipe.
- Stays in the atmosphere for 100 years.
- Blankets the earth, causing it to warm, sea levels rise, glaciers melt.
- Changing climate.
- Can adversely affect humans with changing ecosystems.

Smog emissions (air pollution)

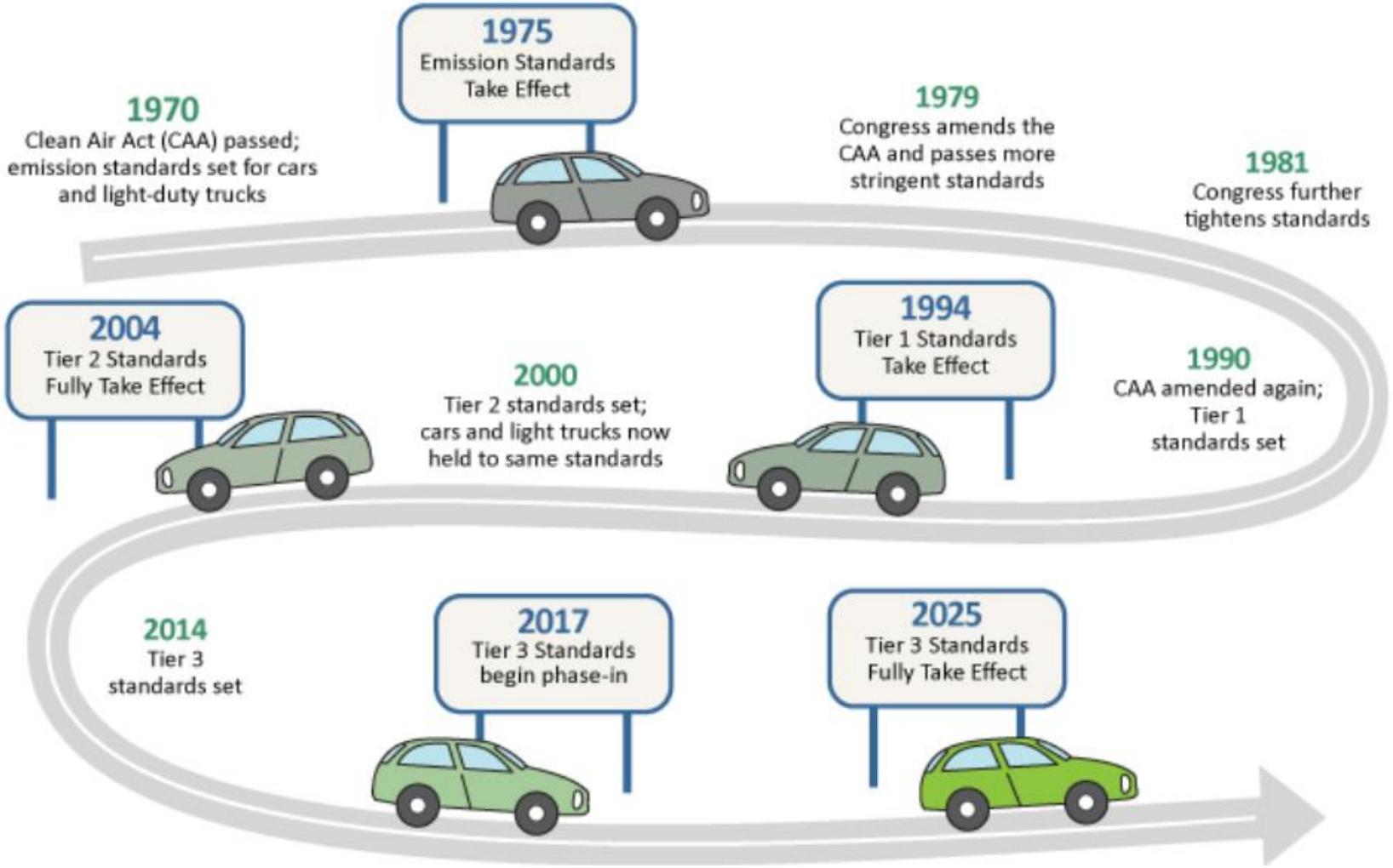
- NO_x (nitrogen oxides), irritates eyes, nose, throat.
- Particulate matter (PM), which can get into your throat or collect on buildings.
- CO (carbon monoxide), colorless, odorless, but poisonous.
- HCHO (formaldehyde), can irritate lungs and is a carcinogen.

When purchasing a vehicle, look for the emissions sticker from the EPA

What information does this emission sticker give you? List five items from the sticker below.

- Fuel economy (miles per gallon) for both city and highway driving
- Cost of fuel per year
- Savings in fuel costs
- Greenhouse Gas (GHG) rating
- Smog rating

The Road to Cleaner Cars...



Turn and Talk:
What are your wonderings/observations from this diagram?

- Making changes to reduce vehicle emissions is a slow process.
- Changes are being made to help the climate, reduce emissions.
- What is a tier 1, 2, 3 standard? (these could be further researched)