COVID-19's IMPACT ON CO2 EMISSIONS IN THE US

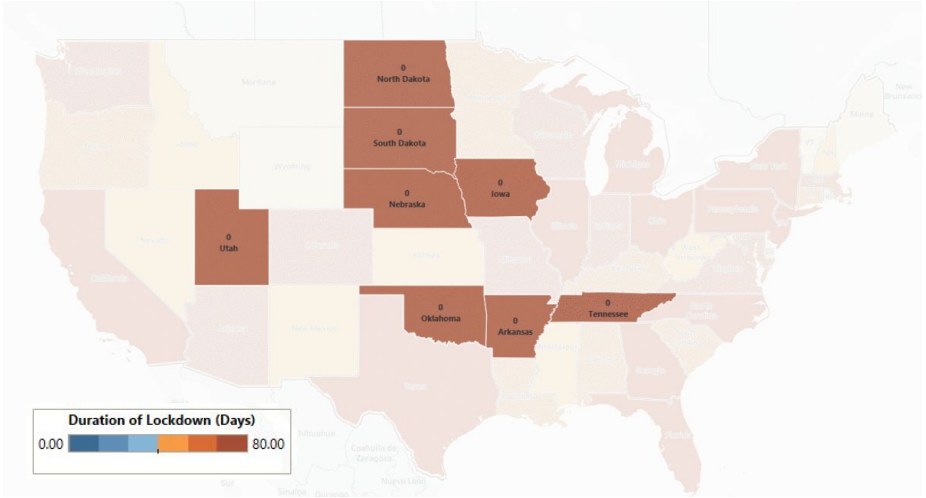
AND WHAT WE CAN LEARN FROM IT

East Coast Group 1: *Chantelle D'Mello, Stephen Knapp, Greig Powers, Rachael Rainville, Daniel Turner, Donald Woodford*

OVERVIEW

- Prior to Coronavirus, air pollution is attributed to **killing 7 million people annually** across the globe, and **emissions of CO2 were rising by 1% each year**, over the past decade.
- The WHO data shows that **9 out of 10** people breathe air containing high levels of pollutants.
- Transportation is America's largest source of carbon emissions and greenhouse gases, accounting for **35.8% of the country's total emissions in 2019**. The two biggest contributors were from air traffic and ground traffic congestion.
- From March to July, 43 states enacted "Stay at Home Orders" to combat the spread of Coronavirus.

Duration of Stay at Home Orders Across the United States



43 States that enacted stay at home orders across the U.S. vs. states did not enact orders

COVID IN THE US

From March to July, 43 states enacted “Stay at Home Orders”
to combat the spread of the Coronavirus

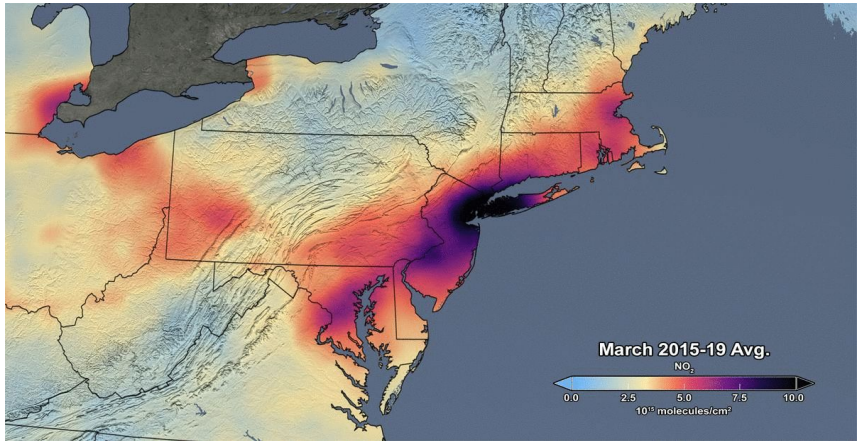
62% of workers
working remotely

43% decrease in
air travel

41% decrease in peak
traffic congestion

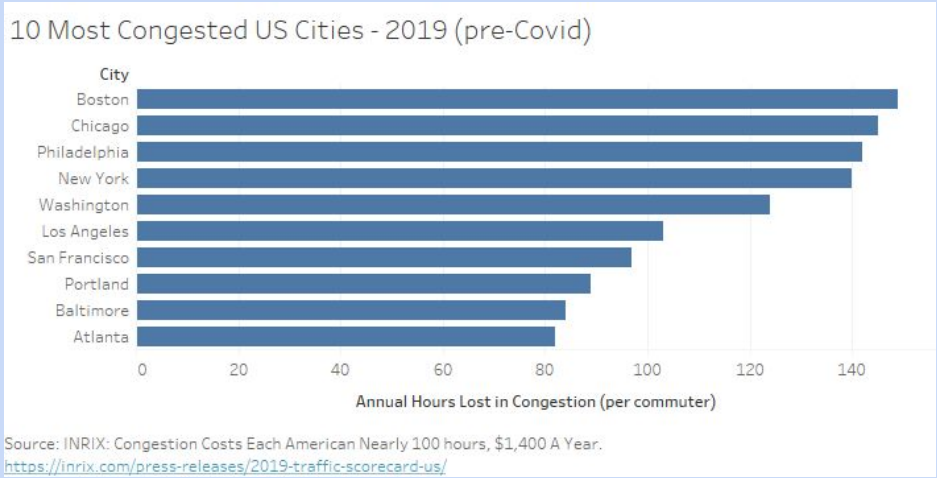
OVERVIEW

- In result of the Stay at Home orders and a decrease in air traffic & ground traffic congestion, **there was a dramatic drop in air pollution, CO2 and NO2 levels** in coronavirus hotspots and across the country.
- Though the decrease in pollution and carbon emissions levels may only be temporary and have had short term effects, **what can we as a country take as lessons learned and future action to take**



The average concentration of pollution over the Northeast U.S in 2019 and 2020 (Credit: NASA Satellite)

TRAFFIC TALES

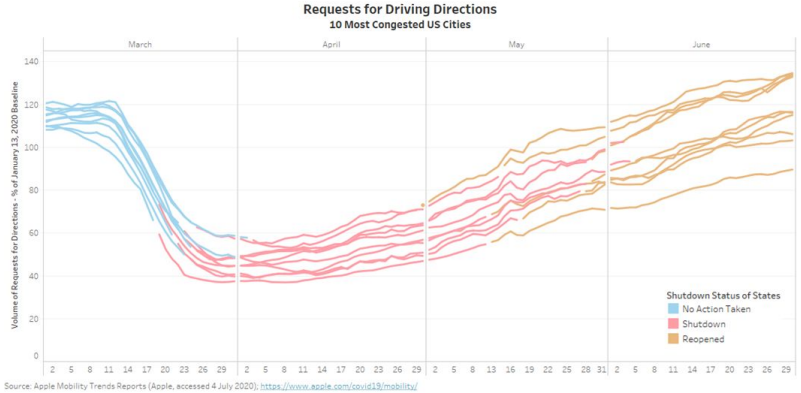


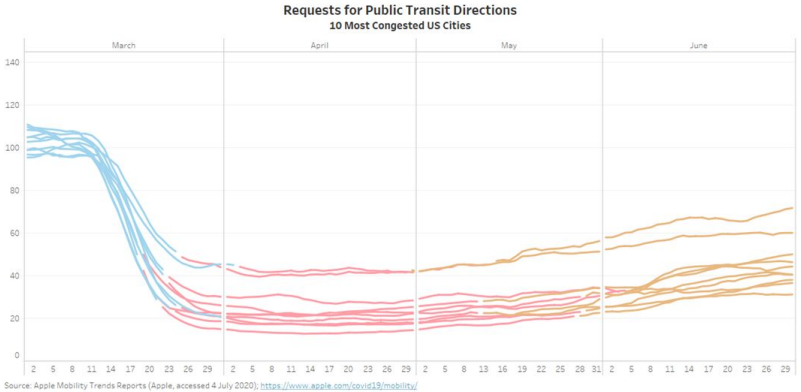
Historically congested cities stand
to gain the most from **a reduction in traffic**

“Heavy congestion results in slower speeds and greater speed fluctuation, resulting in higher CO2 emissions”

Barth and Boriboonsomsin, 2008
M. Barth, K. Boriboonsomsin
Real-world carbon dioxide impacts of traffic congestion
Transport. Res. Rec.: J. Transport. Res. Board, 2058 (2008), pp. 163-171

DRIVING LEVELS PLUMMETED AND ARE RETURNING, BUT NOT FOR PUBLIC TRANSIT





Data generated from Apple Maps indicated that both driving and public transit usage plummeted as shutdown orders were put in place. However, as shutdowns progressed and states were reopened:

- Drivers are returning to the roads
- Public transit usage remains low, as people continue to stay away from crowded spaces.

As workers return to work, **CO2 emissions have the potential to increase even more if public transit usage remains low and other mitigating steps (such as work from home) are not taken.**

Cities compared (with 2019 INRIX congestion rank & hours in congestion per commuter):

1. Boston, MA (149)
2. Chicago, IL (145)
3. Philadelphia, PA (142)
4. New York, NY (140)
5. Washington, DC (124)
6. Los Angeles, CA (103)
7. San Francisco, CA (97)
8. Portland, OR (89)
9. Baltimore, MD (84)
10. Atlanta, GA (82)

WALKING DURING COVID

Looked at Apple Mobility data compiled from Apple Map requests

Mobility measures for every state are indexed to 100 at the beginning of the series, so trends are relative to that baseline. Don't know about the absolute volume of usage of the Maps service.

Main Question: Have people been walking more during/as a result of COVID?

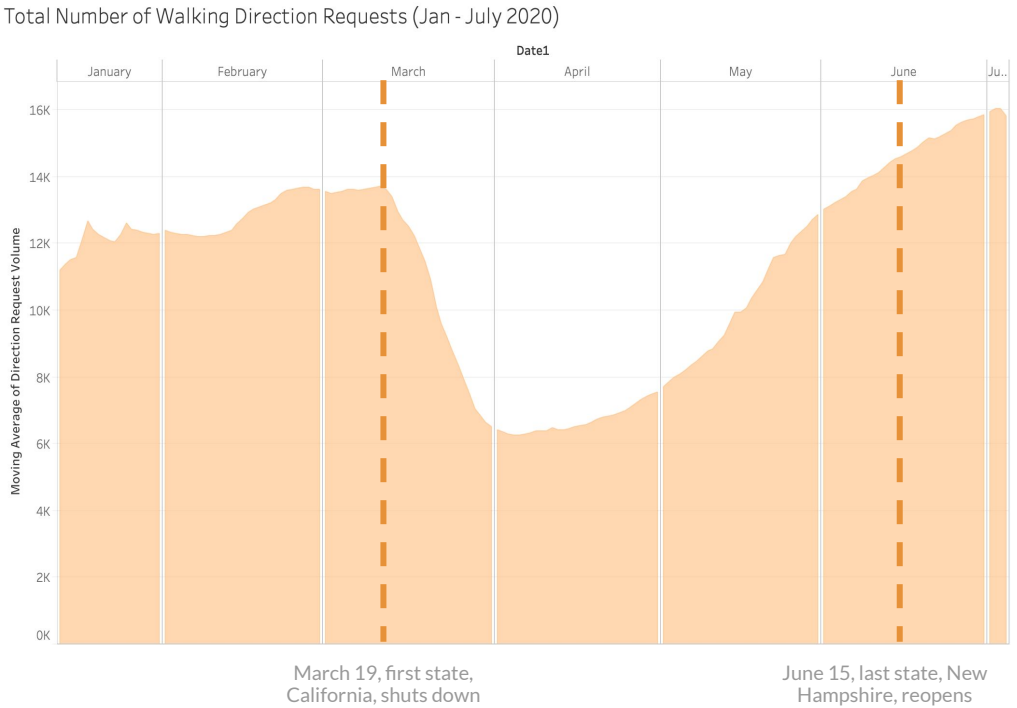
Overall,

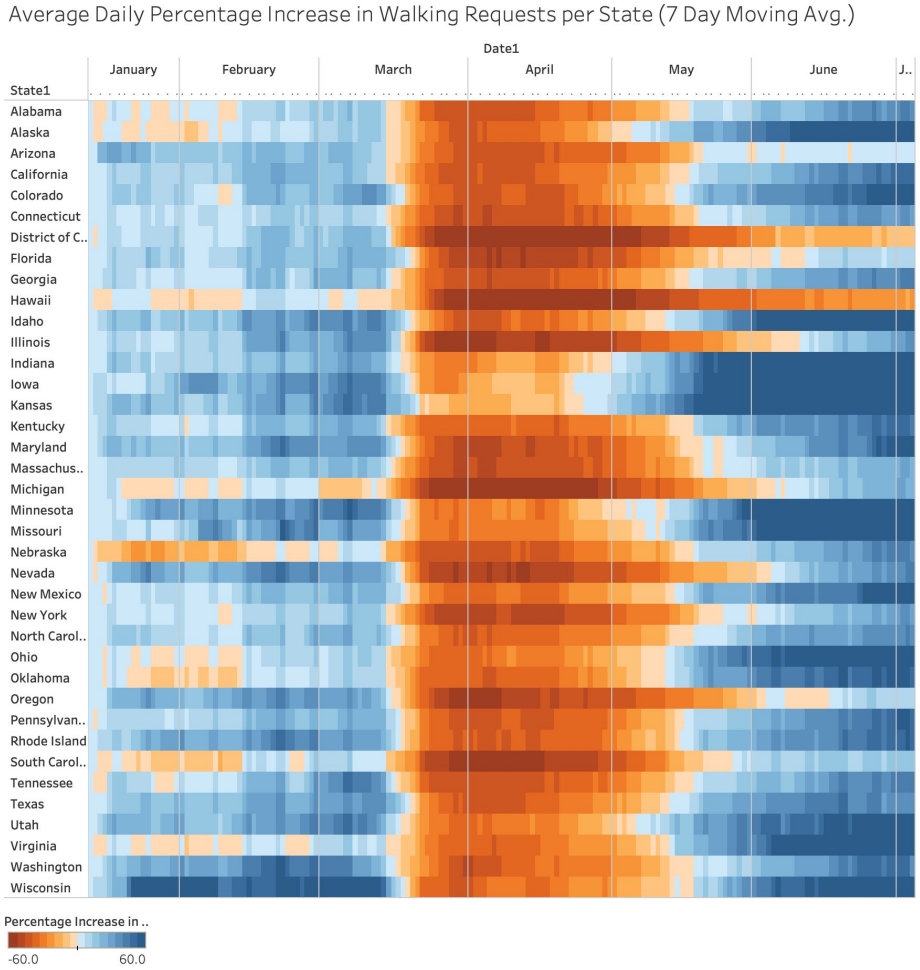
YES!

After a sharp drop in March and April, when states were most restrictive of people's movements, volumes of walking requests have now surpassed those in Jan/Feb

Better weather + lack of indoor entertainment options = more walking and being outdoors

One of the few upsides to the situation





INCREASE IN WALKING PER STATE

(% Increase, 7 Day Moving Average)

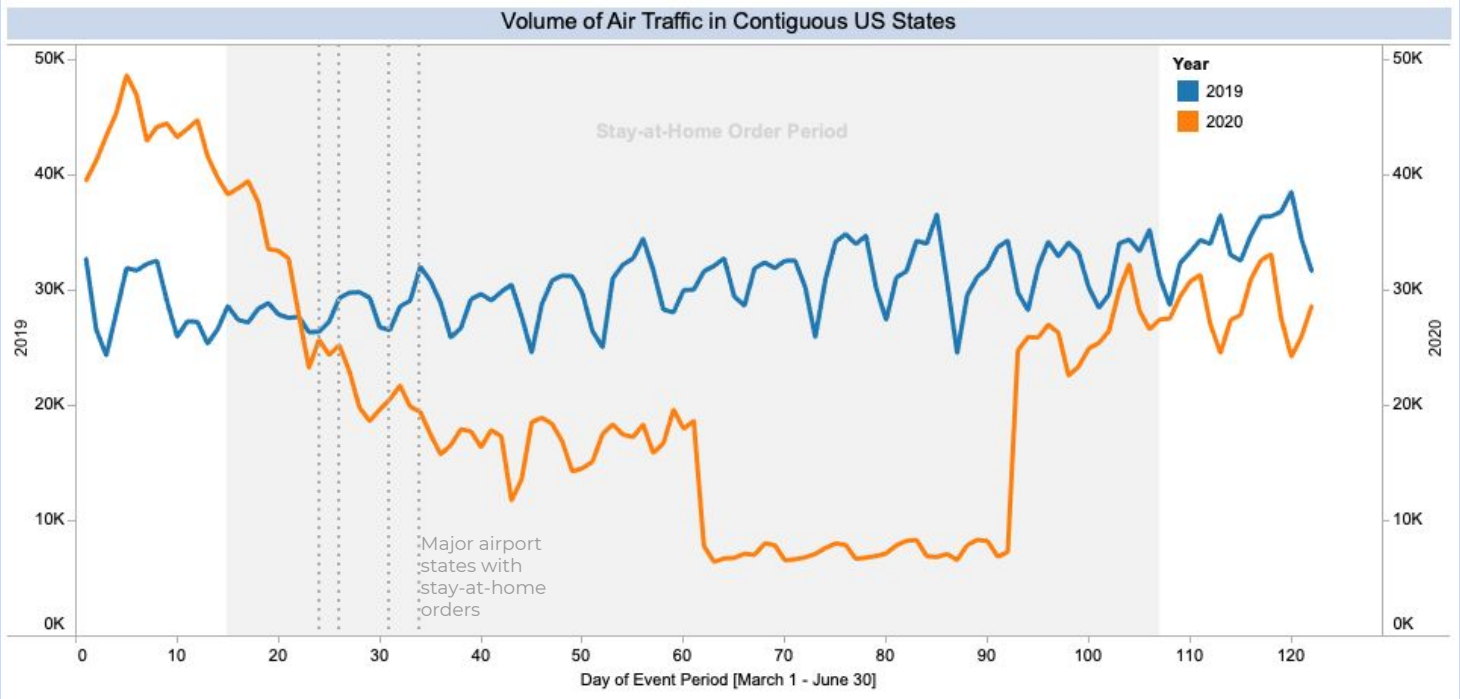
- Greater volume of walking direction requests now than before lockdowns in most states
- Assumption is that people are also walking longer/exploring more on foot because they wouldn't ask for directions to places they frequent
- States saw a median increase of 27% more requests from mid-May to now than the baseline
- Virginia had the highest single-day increase at 425% and even vehicle-dense states like California saw single-day increases of up to 126% in walking requests

HOW DOES THIS HELP THE ENVIRONMENT?

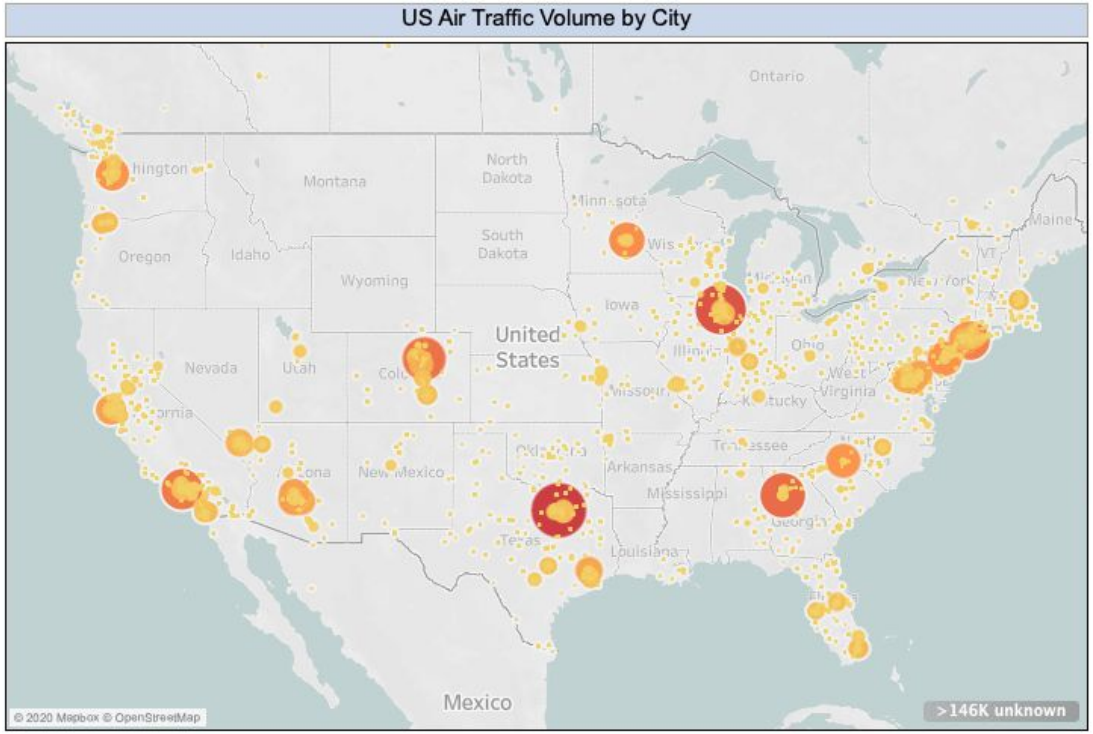
In the US the average passenger vehicle on the road releases **404g of CO2 per mile**

So, quite simply, every kilometer you walk instead of driving saves 404g of CO2. The more you walk, the more you save.

AIR TRAVEL REDUCTIONS DURING STAY-AT-HOME ORDERS



AIR TRAFFIC VOLUME BY CITY



Year

2020

Show history

Highlight Destination

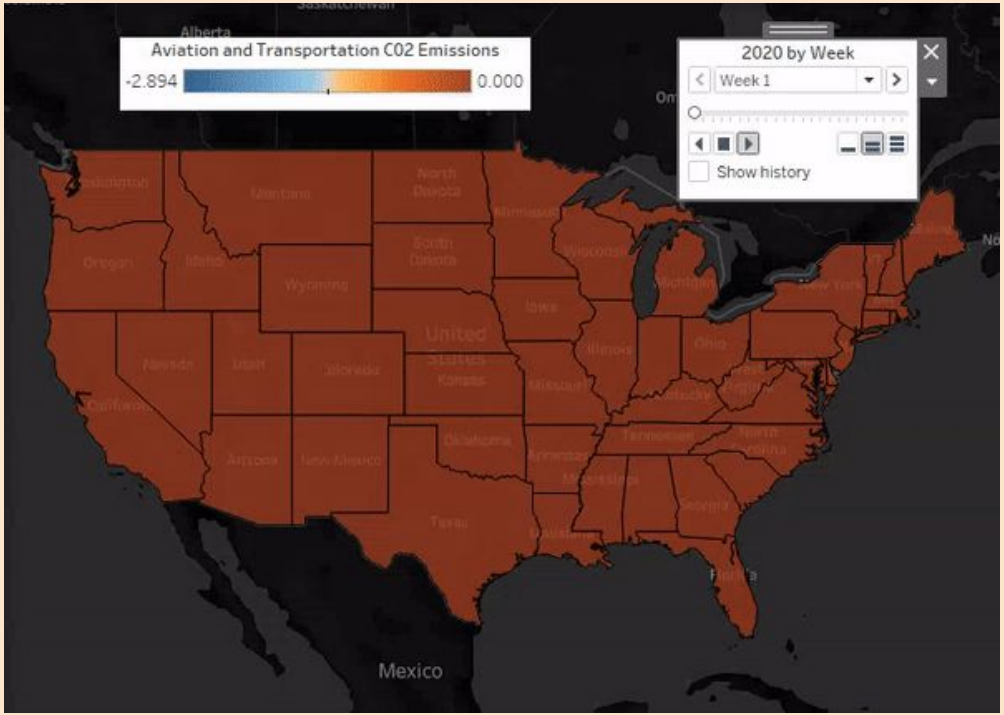
Highlight Destination

Highlight Origin

Highlight Origin

Takeoffs & Landings

1 — 31,301



CO2 EMISSION DECLINES
(SHORT TERM)

During the peak of stay at home orders the combined aviation and transportation C02 emissions in the United States dropped by 25% from pre-COVID19 levels across the country.

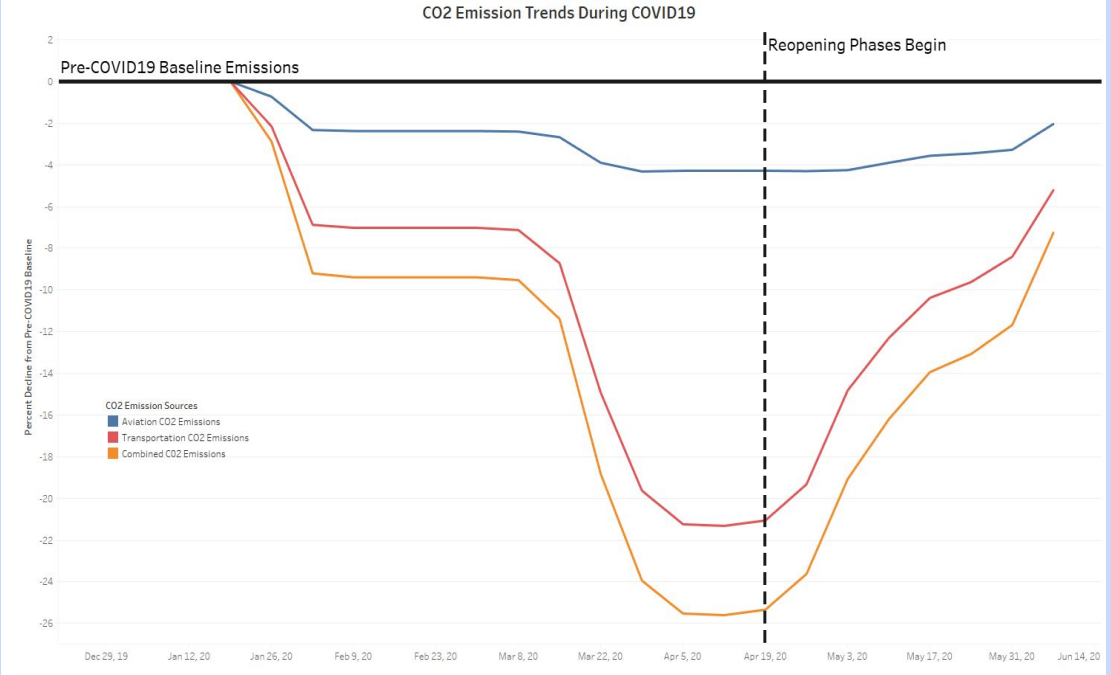
States such as California and Texas saw some of the most dramatic declines:

- California: 2.9%
- Texas: 2.4%

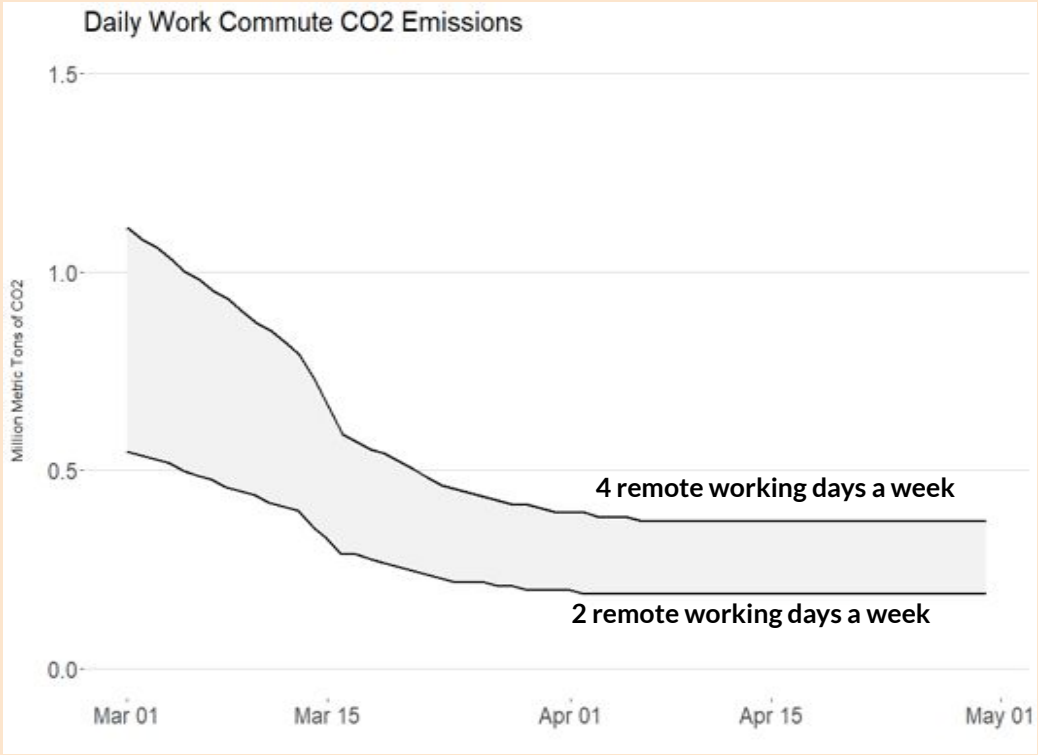
CO2 EMISSION DECLINES
(LONG TERM)

Will this emissions decline have a long term impact?

- Short term decreases historically are followed by an increase.
- During the 2008 Financial Crisis, CO2 emissions declined sharply but then climbed 6% higher following the recession in 2010.
- As states have begun to reopen the CO2 emissions have already begun to increase.



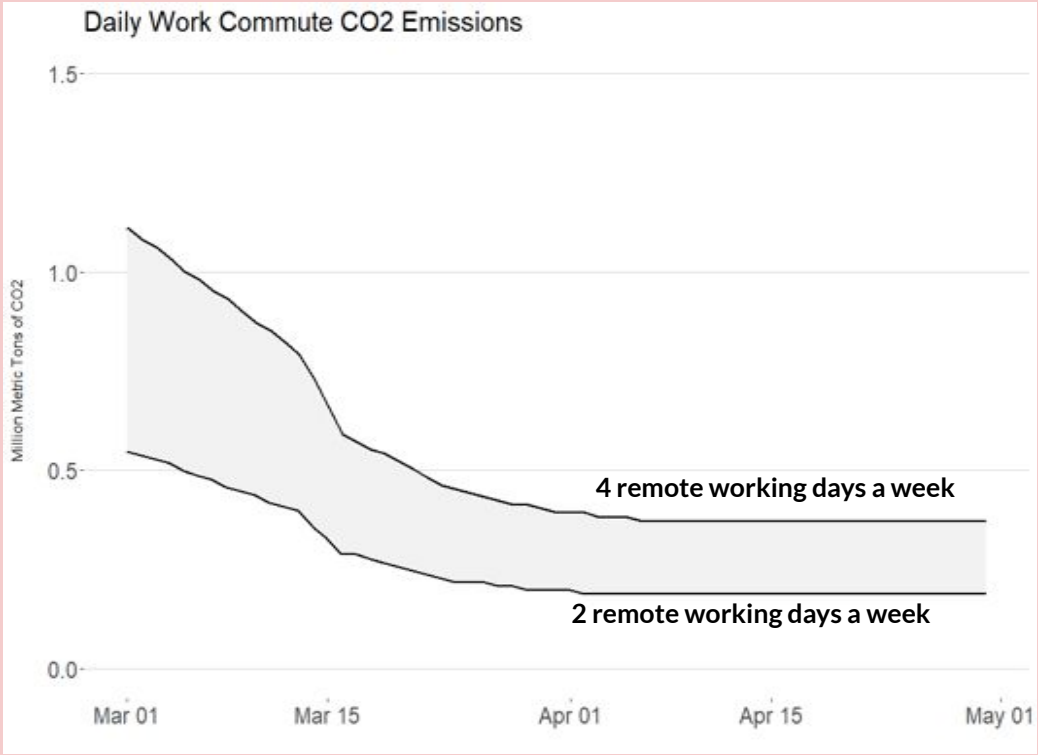
MODELING CO2 EMISSIONS FROM REMOTE WORK DATA



Remote work increased from 3.6% to 62% of the working population during the pandemic [Gallup Poll].

- This encompasses both full time remote workers and those who work remote less than full time
- The model was created with the assumption the average US remote worker is remote between two and four days each week

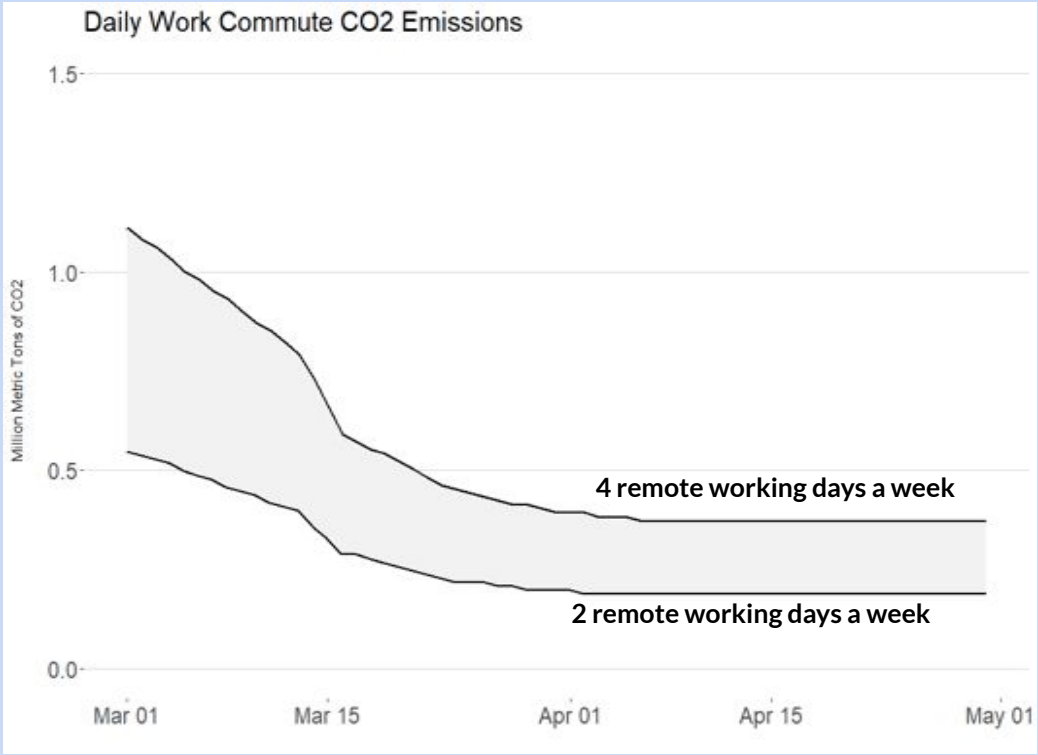
MODELING CO2 EMISSIONS FROM REMOTE WORK DATA



This significantly reduced the number of people using personal vehicles to commute to the office.

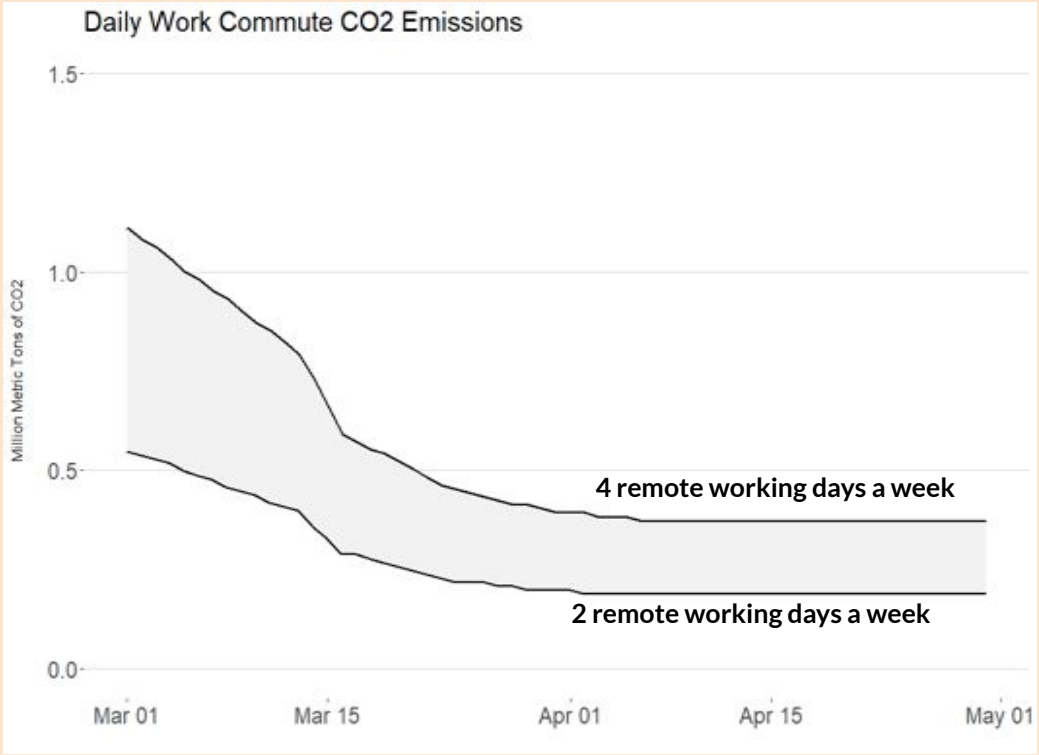
- 76% of people commute with an automobile by themselves and 9% of people commute with an automobile in a carpool situation [American Community Survey]
- Average commute is 16 miles one-way [ABC New Poll]

MODELING CO2 EMISSIONS FROM REMOTE WORK DATA



The numbers were adjusted for the sharp increase in unemployment during the pandemic [US Bureau of Labor Statistics].

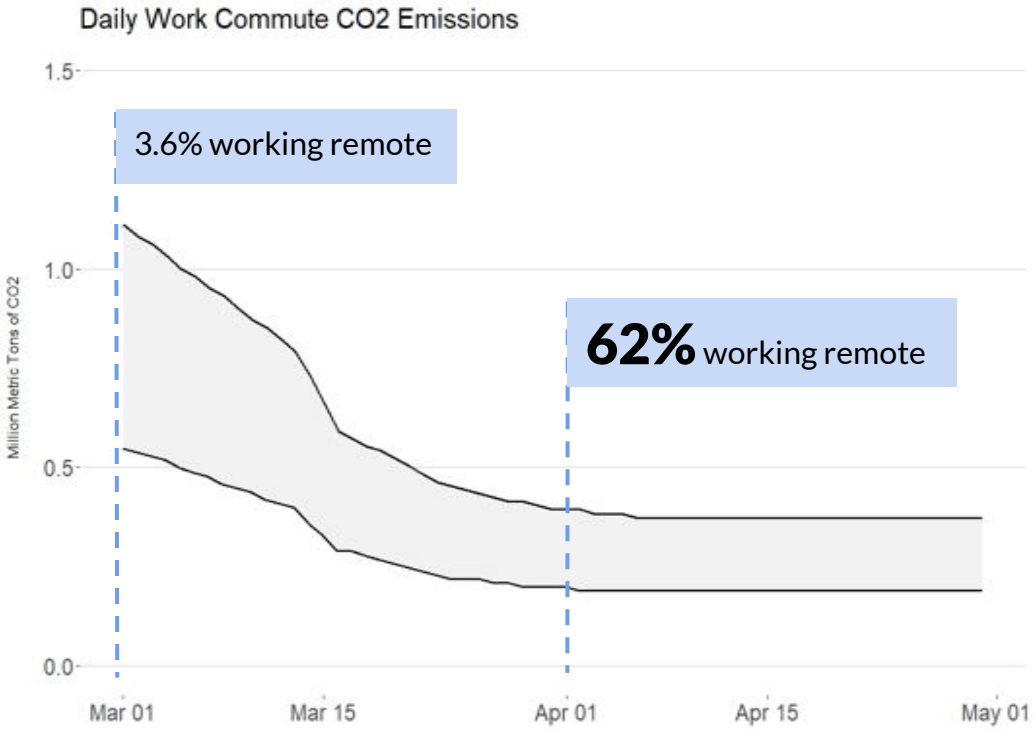
MODELING CO2 EMISSIONS FROM REMOTE WORK DATA



The commuter emissions were calculated based on numbers from the Environmental Protection Agency:

- Average MPG of an automobile: 24.9
- Grams of CO2 emitted by a gallon of gasoline: 8887

ELIMINATING COMMUTES AND REDUCING CO2 WITH REMOTE WORKING



The dramatic increase in remote work since the start of the pandemic has potentially **reduced CO2 emissions by 500,000 metric tons per day**.

This reduction is **approximately 3%** of the nation's pre-pandemic emissions.

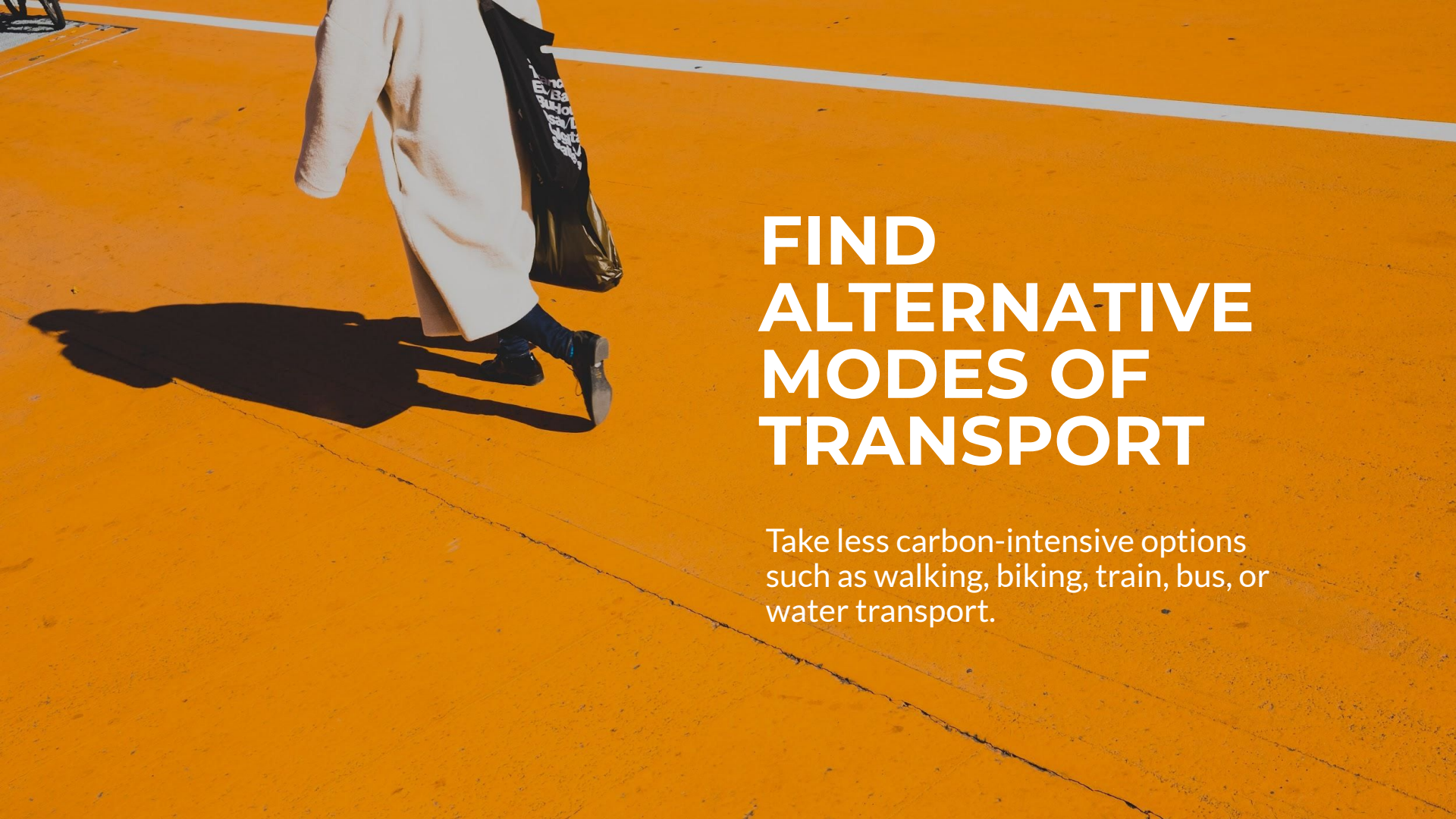
The modeled reduction in emissions in the month of April alone was the equivalent of the CO2 sequestered by *a forest the size of West Virginia.*

CALLS TO ACTION

"The stay-at-home orders show how fast we can bring down pollution when we reduce our burning of fossil fuels."
- National Geographic, April 2020

WORK FROM HOME MORE

How can we sustain this trend so that both employers and employees benefit along with the environment?



FIND ALTERNATIVE MODES OF TRANSPORT

Take less carbon-intensive options such as walking, biking, train, bus, or water transport.

FLY LESS

Conduct business virtually, take vacations closer to home or make vacations longer but less frequent.


SPREAD THE
WORD
Encourage and educate people about the benefits of lifestyle changes the stay-at-home orders brought about.

REFERENCES

- Kienapple, B. (2020, June 14). Coronavirus's Impact on the Environment [Infographic]. Retrieved July 09, 2020, from https://venngage.com/blog/coronavirus-impact-on-environment-infographic/
- Stone, M. (2020, May 08). Carbon emissions are falling sharply due to coronavirus. But not for long. Retrieved July 09, 2020, from https://www.nationalgeographic.com/science/2020/04/coronavirus-causing-carbon-emissions-to-fall-but-not-for-long/
- Blumberg, S. (2020, April 09). Data Shows 30 Percent Drop In Air Pollution Over Northeast U.S. Retrieved July 09, 2020, from https://www.nasa.gov/feature/goddard/2020/drop-in-air-pollution-over-northeast
- Gardiner, B. (2020, April 20). Pollution made COVID-19 worse. Now, lockdowns are clearing the air. Retrieved July 09, 2020, from https://www.nationalgeographic.com/science/2020/04/pollution-made-the-pandemic-worse-but-lockdowns-clean-the-sky/
- United States Environmental Protection Agency. (2020, March). Greenhouse Gas Equivalencies Calculator [Interactive Calculator]. Retrieved July 09, 2020, from https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator
- United States Environmental Protection Agency. (2018). Greenhouse Gas Inventory Explorer [Interactive Data Tool]. Retrieved July 09, 2020, from https://cfpub.epa.gov/ghgdata/inventoryexplorer/
- United States Environmental Protection Agency. (2020, March). Automotive Trends Report [Interactive Data Tool]. Retrieved July 09, 2020, from https://www.epa.gov/automotive-trends/explore-automotive-trends-data
- United States Bureau of Labor Statistics. (2020, June 19). Civilian Labor Force and Unemployment by State and Selected Area, Seasonally Adjusted. Retrieved July 09, 2020, from https://www.bls.gov/news.release/laus.t01.htm
- McKenzie, B. (2015, August). Who Drives to Work? Commuting by Automobile in the United States: 2013 [American Community Survey Reports]. Retrieved July 09, 2020, from https://www.census.gov/content/dam/Census/library/publications/2015/acs/acs-32.pdf
- Hickman, A. and Saad, L. (2020, May 22). Reviewing Remote Work in the U.S. Under COVID-19 [Gallup Poll]. Retrieved July 09, 2020, from https://news.gallup.com/poll/311375/reviewing-remote-work-covid.aspx
- Langer, G. (2007, July 13). Poll: Traffic in the United States [ABC News Poll]. Retrieved July 09, 2020, from https://abcnews.go.com/Technology/Traffic/story?id=485098&page=1

REFERENCES

- Le Quéré, C., Jackson, R., Jones, M., Smith, A., Abernethy, S., Andrew, R., De-Gol, A., Shan, Y., Canadell, J., Friedlingstein, P., Creutzig, F., & Peters, G. (2020). *Supplementary data to: Le Quéré et al (2020), Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement* (Version 1.0). Global Carbon Project. https://doi.org/10.18160/RQDW-BTJU
- Schäfer, M., Strohmeier, M., Lenders, V., Martinovic, I., & Wilhelm, M. (2014). Bringing up OpenSky: A large-scale ADS-B sensor network for research. IPSN-14 Proceedings of the 13th International Symposium on Information Processing in Sensor Networks, 83–94. https://doi.org/10.1109/IPSN.2014.6846743
- Tabuchi, H. (2019, September 19). 'Worse Than Anyone Expected': Air Travel Emissions Vastly Outpace Predictions. The New York Times. https://www.nytimes.com/2019/09/19/climate/air-travel-emissions.html
- Wilkinson, D., & Chavez, L. T. (2020, April 16). How Covid-19 Could Impact the Climate Crisis. Retrieved July 8, 2020, from https://www.hrw.org/news/2020/04/16/how-covid-19-could-impact-climate-crisis
- Wagner, I. "Total Number of Automobiles in the U.S. by State." Statista, 12 Mar. 2020, www.statista.com/statistics/196010/total-number-of-registered-automobiles-in-the-us-by-state/#:~:text=California%20had%20the%20most%20automobile,almost%20887%2C000%20sold%20in%202018.
- "Greenhouse Gas Emissions from a Typical Passenger Vehicle." EPA, Environmental Protection Agency, 10 May 2018, www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle.
- *COVID-19—Mobility Trends Reports*. (2020). Apple. https://www.apple.com/covid19/mobility