

Forest Dieback Due to Sea Level Rise



NCA4; Volume II, Ch. 18

<http://nca2018.globalchange.gov>

Atlantic white cedars dying near the banks of the Bass River in New Jersey show wetland encroachment on forested areas.
Photo credit: Ted Blanco/Climate Central.

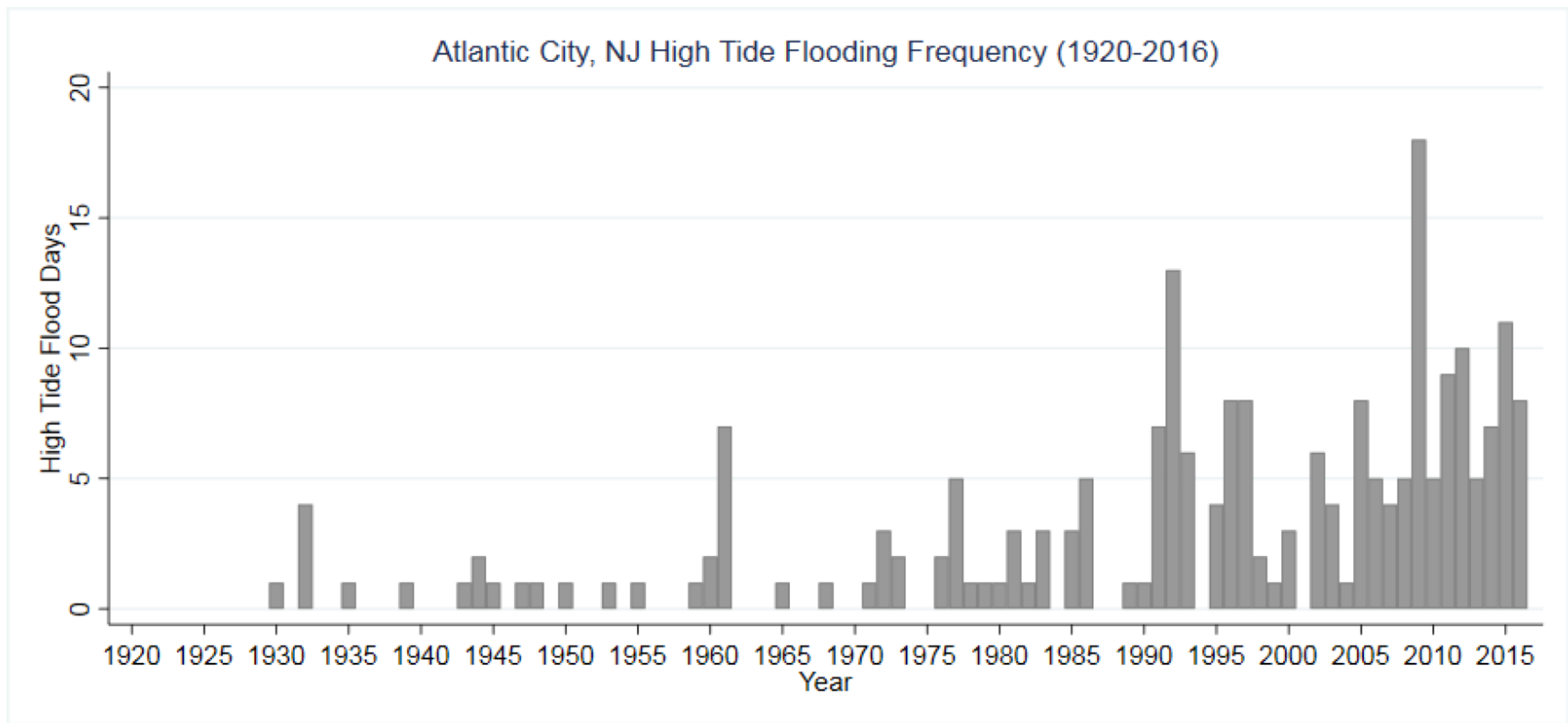


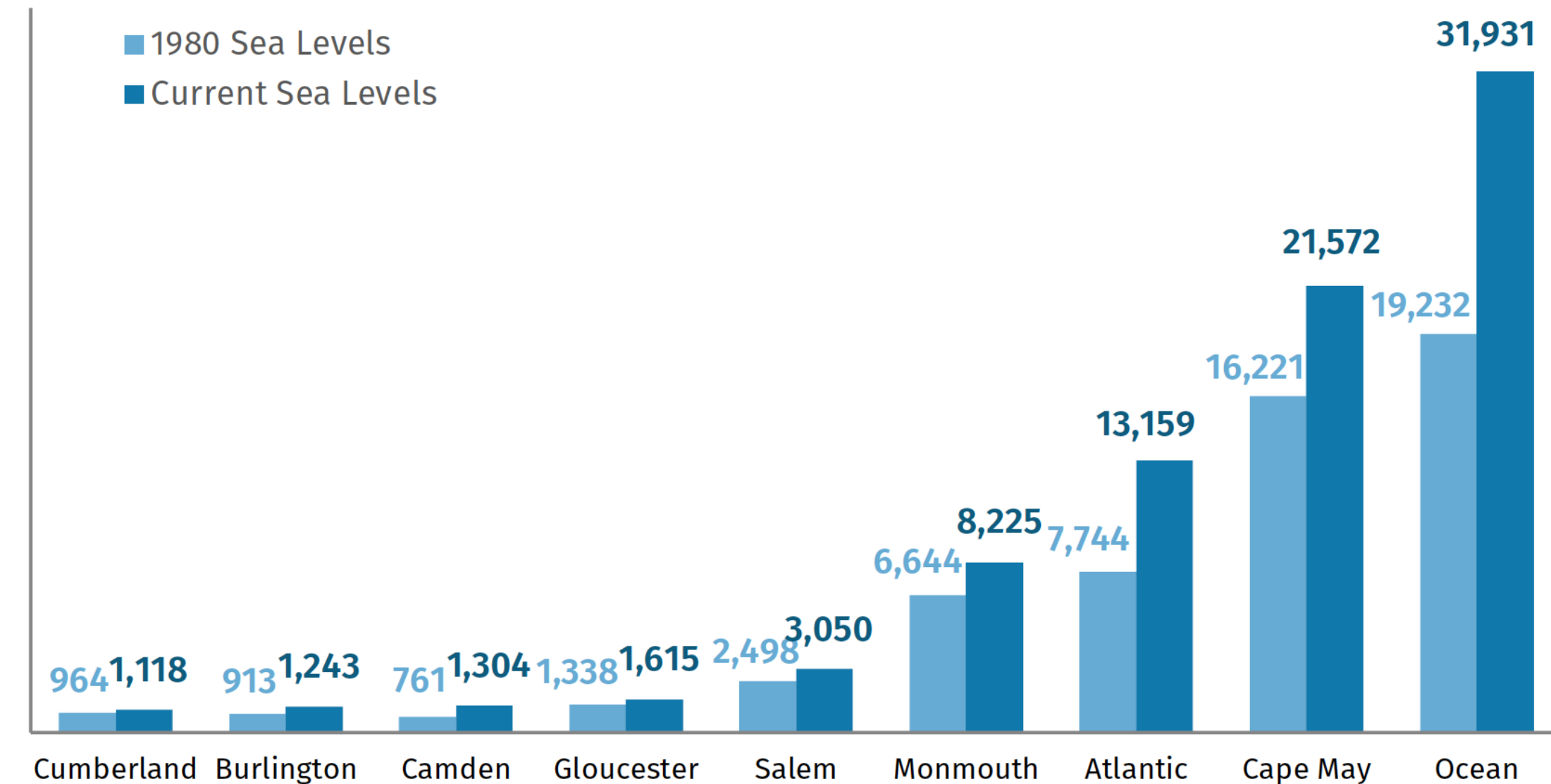
Figure 8. Historical High Tide Flood Frequency (# of flood days) for Atlantic City, NJ (Sweet et al., 2018)

Kopp et al. New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel. Rutgers, The State University of New Jersey. Prepared for the New Jersey Department of Environmental Protection. Trenton, New Jersey.

FIGURE 3

Change in New Jersey annual flood risk

Number of current properties at risk of annual flooding, by county, comparing sea levels in 1980 to sea levels today

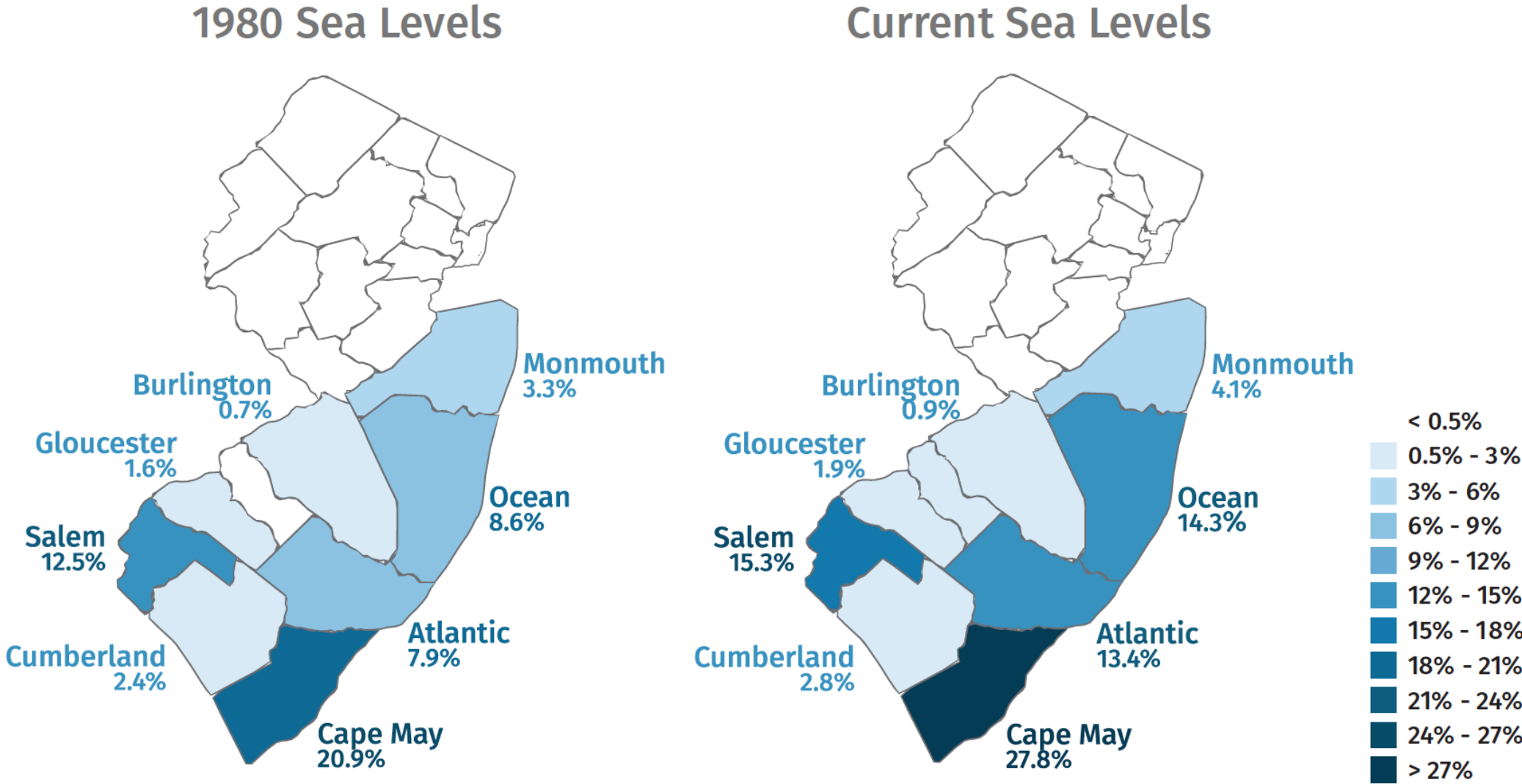


Source: Rhodium Group and First Street Foundation analysis

FIGURE 4

Mapping New Jersey flood risk

Percent of all buildings at risk of annual flooding, comparing sea levels in 1980 to sea levels today

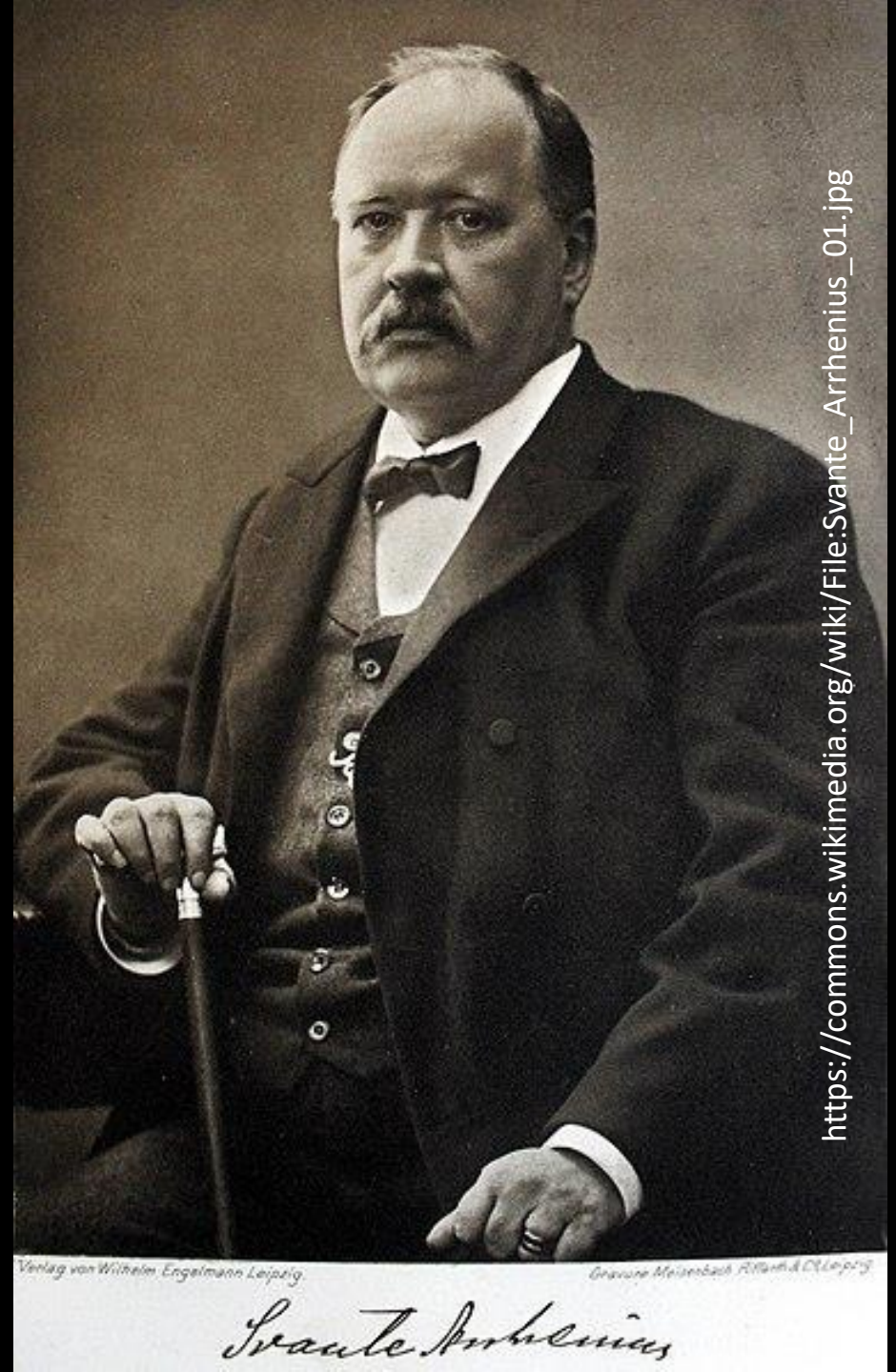


Source: Rhodium Group and First Street Foundation analysis



Prediction

Svante Arrhenius
(1859-1927)
calculated how much
increases in
atmospheric carbon
dioxide would increase
the global surface
temperature



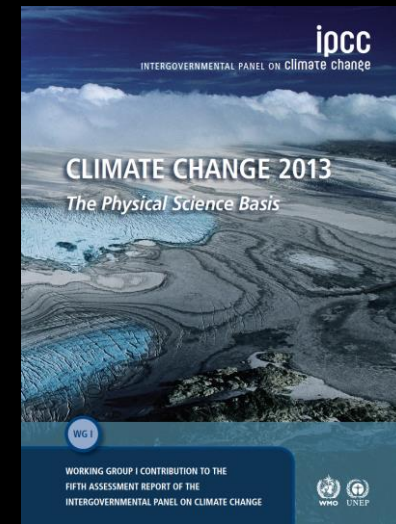
Detection
of
change

vs

Attribution
of the
causes

Detection of change

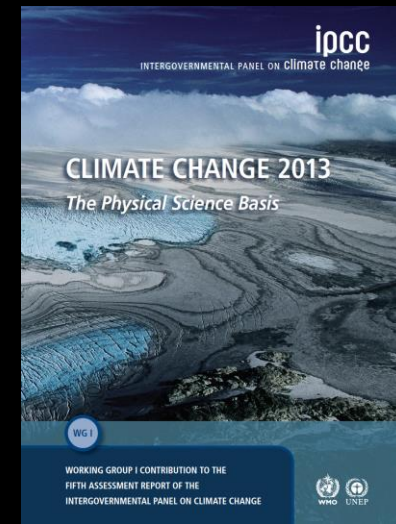
“Warming of the climate system is **unequivocal**, and since the 1950s, many of the observed changes are unprecedented over decades to millennia.” – IPCC 2013

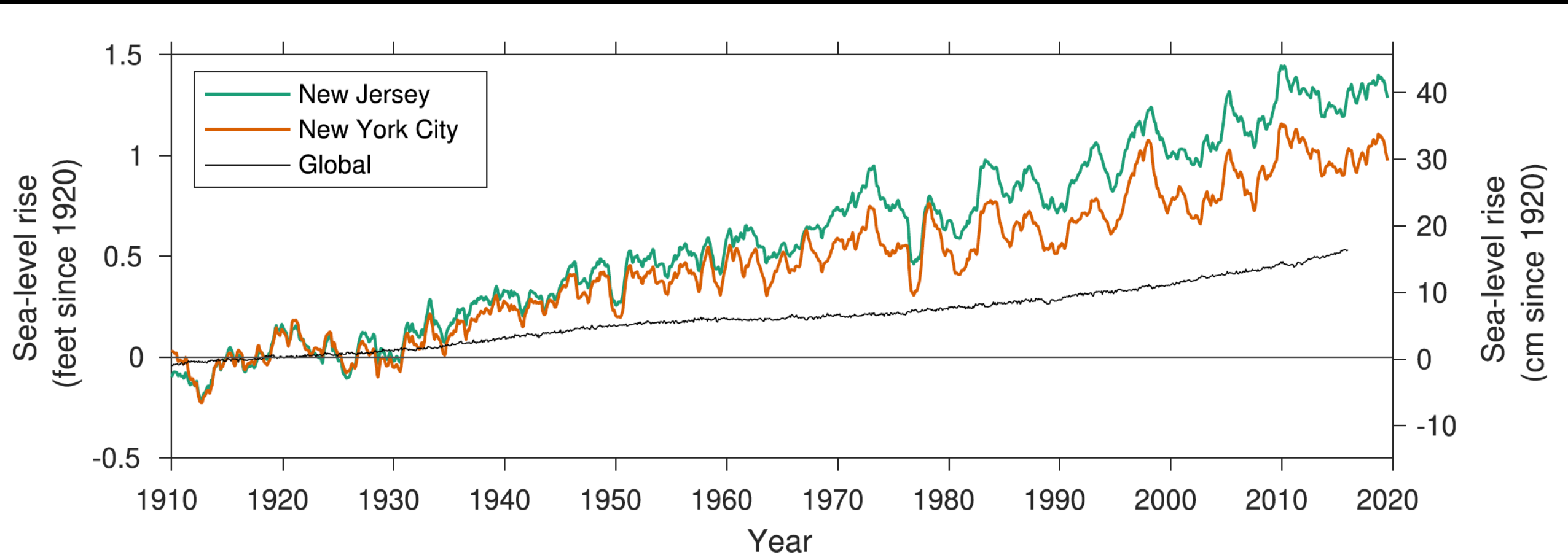


Attribution

“It is **extremely likely* that human influence has been the **dominant cause** of the observed warming since the mid-20th century.”**

*extremely likely = 95-100% probability of an outcome or result.

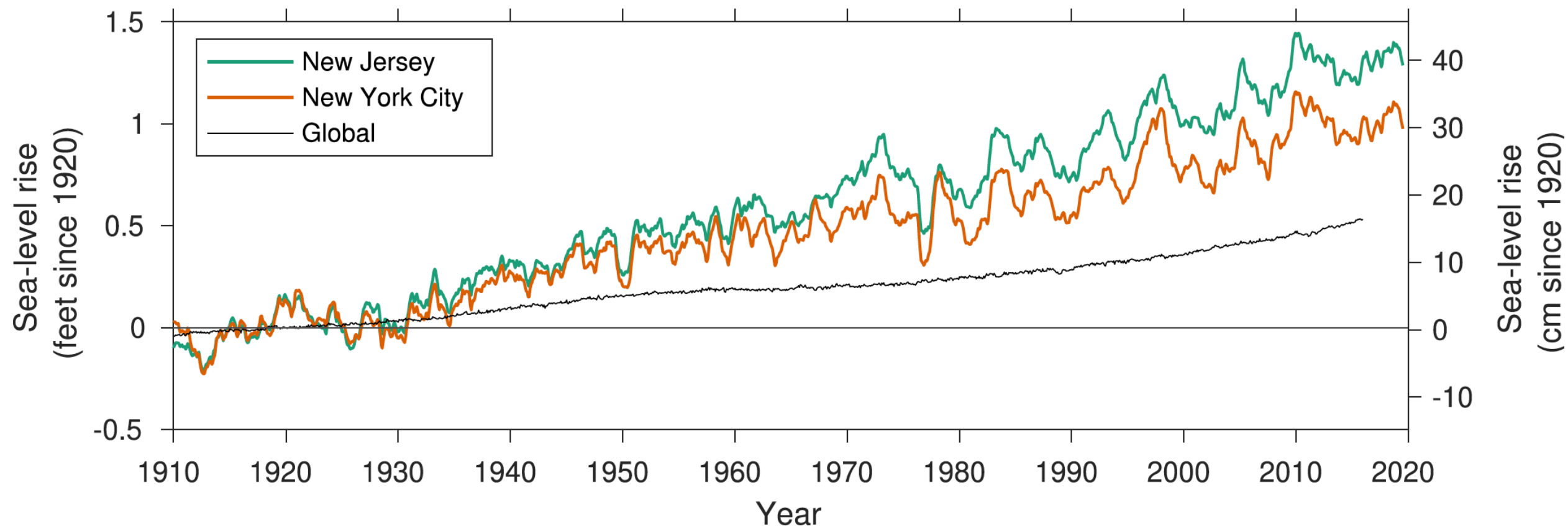




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NJ SLR since 1911 =

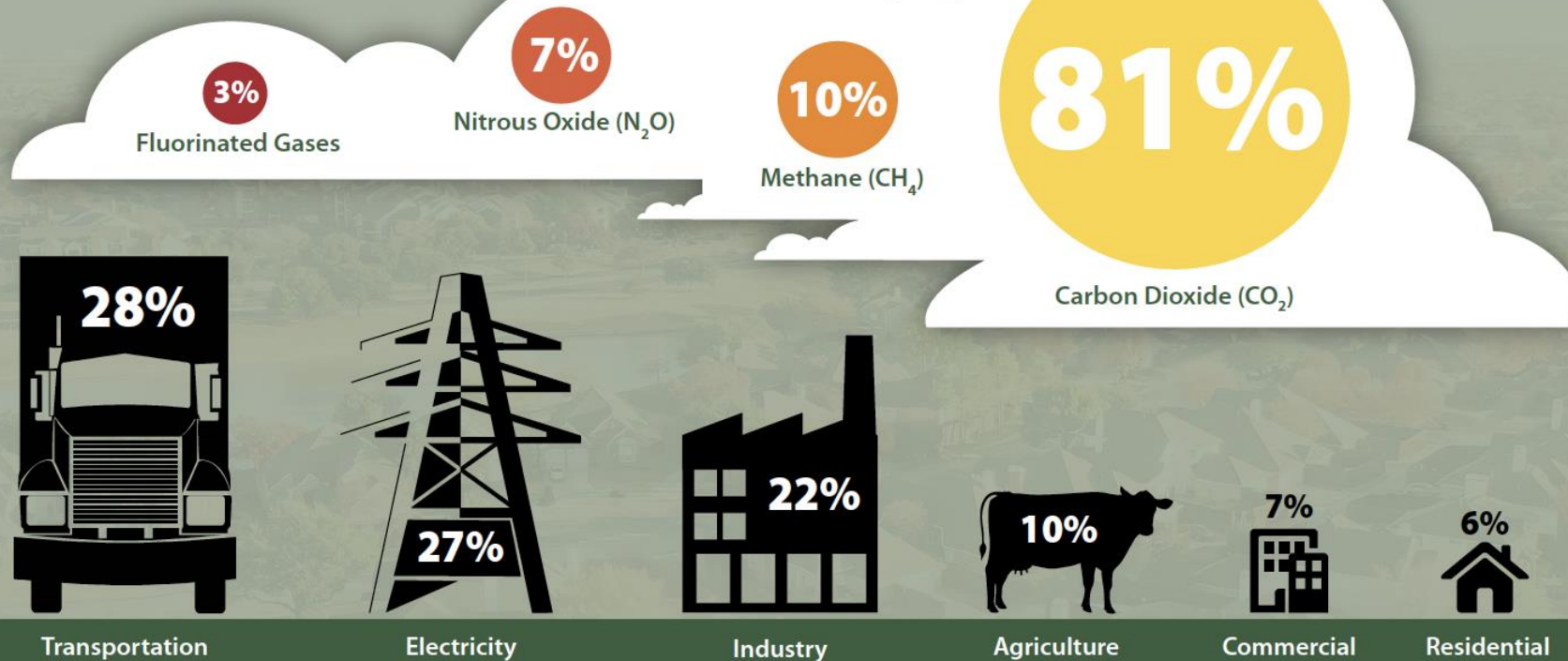
~8 inches Global SLR + ~7 inches natural subsidence + ~3 inches groundwater withdrawal



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U.S. Greenhouse Gas Emissions in 2018*

Total U.S. Greenhouse Gas Emissions by Economic Sector in 2018*



U.S. Greenhouse Gas Emissions

2018 Total Emissions	2017–2018 Change	1990–2018 Change
6,677 million metric tons of CO ₂ equivalent <div> CO₂ emissions from fossil fuel combustion: 75.4% of total emissions </div> <div> CO₂ removals by forests and other lands: 12.0% of total emissions </div>	<div> ↑ 2.9% total emissions </div> <div> ↑ 3.3% CO₂ emissions </div> <div> ↑ 2.9% CO₂ emissions from fossil fuel combustion </div>	<div> ↑ 3.7% total emissions </div> <div> ↑ 5.8% CO₂ emissions </div> <div> ↑ 6.2% CO₂ emissions from fossil fuel combustion </div>

To learn more about the inventory, visit www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks, or explore the data at <https://cfpub.epa.gov/ghgdata/inventoryexplorer/>.

*Percentages may not add to 100% due to independent rounding and the way the inventory quantifies U.S. territories (not shown) as a separate sector.

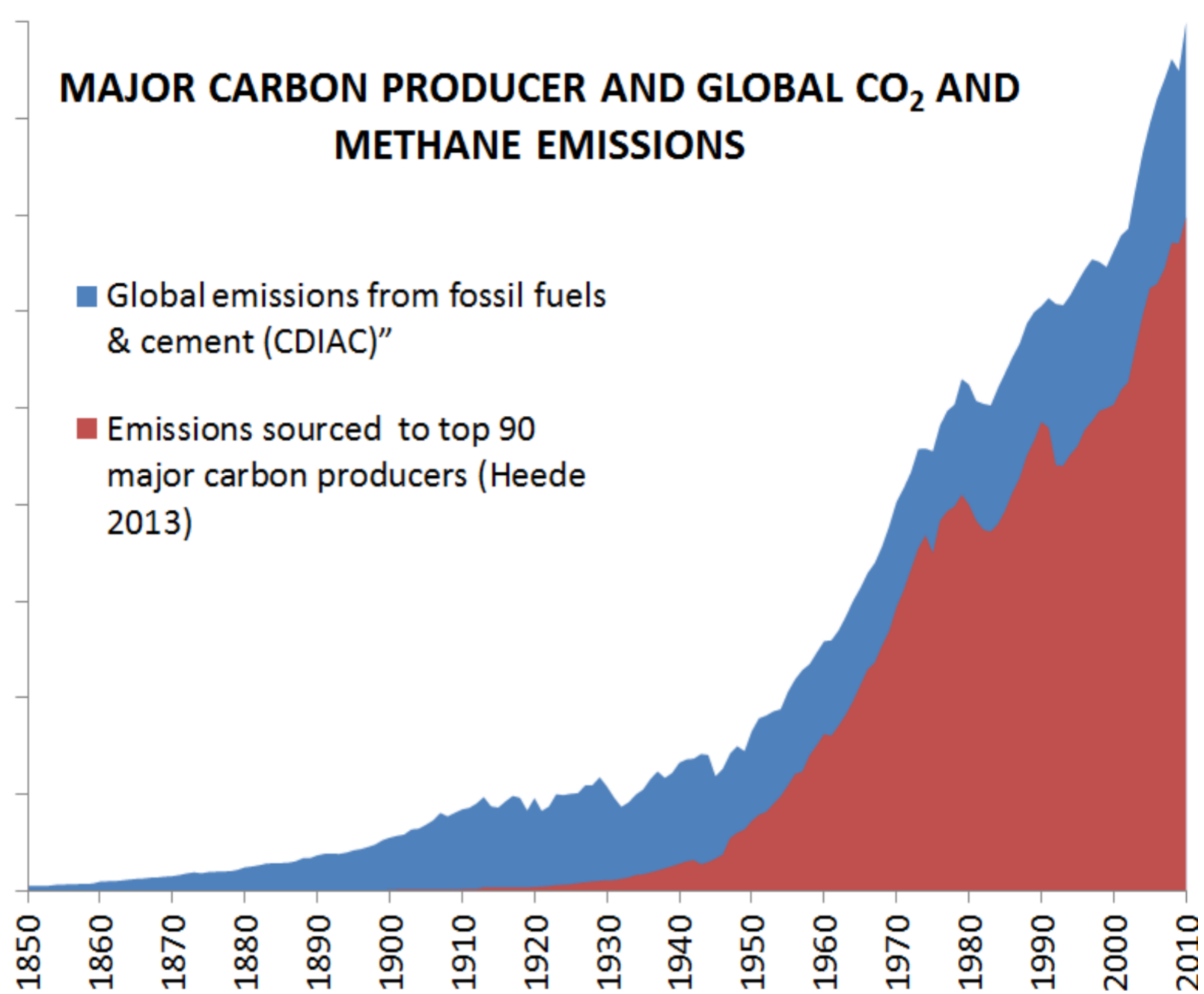


April 2020
EPA 430-F-20-002

Million Tonnes CO₂e

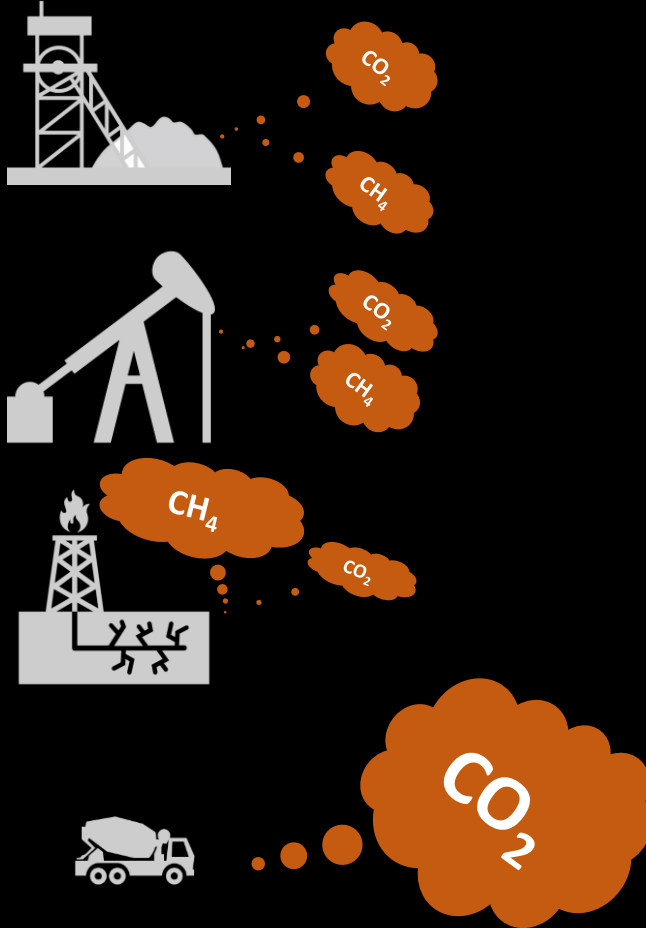
MAJOR CARBON PRODUCER AND GLOBAL CO₂ AND METHANE EMISSIONS

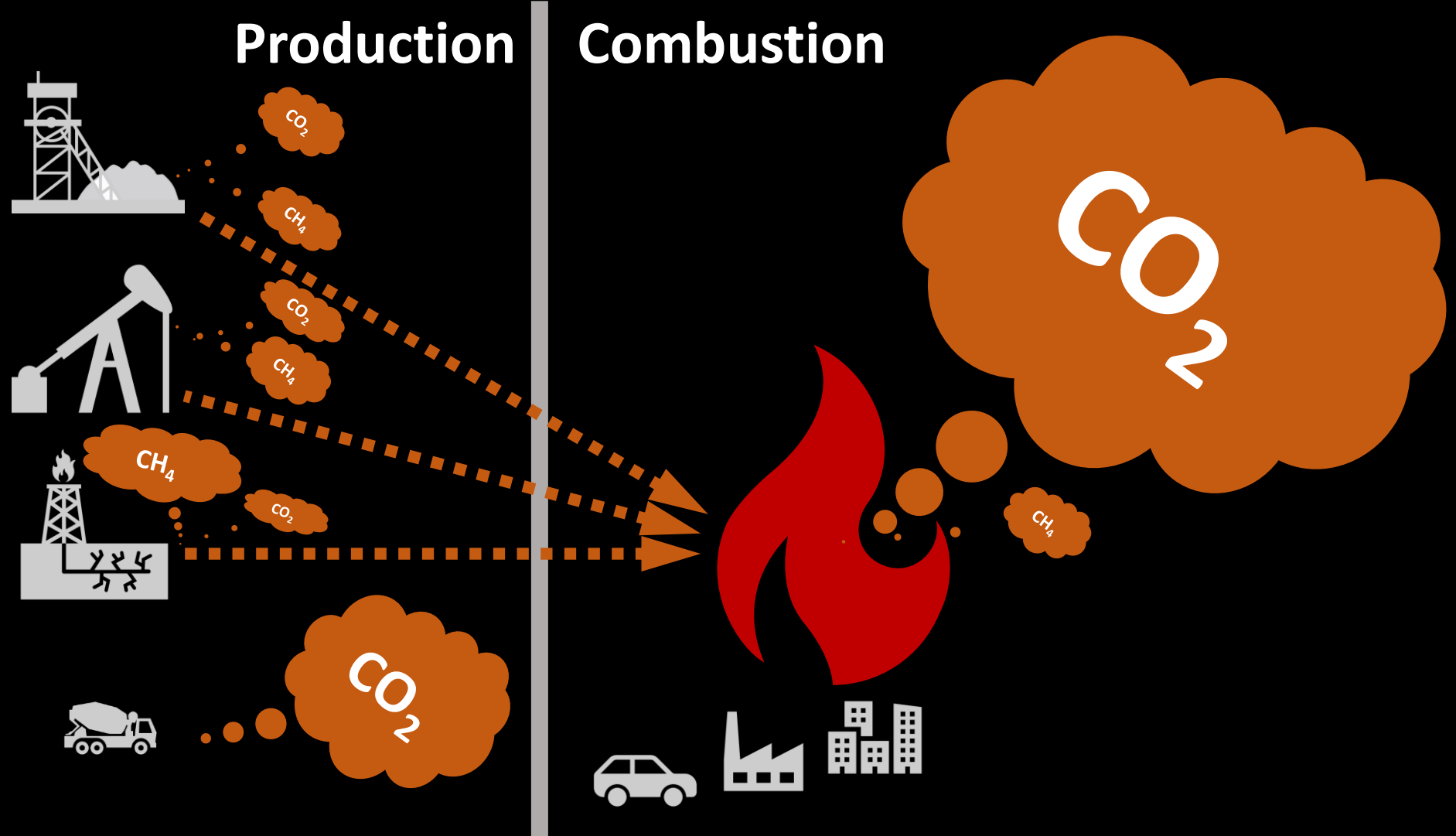
- Global emissions from fossil fuels & cement (CDIAC)"
- Emissions sourced to top 90 major carbon producers (Heede 2013)

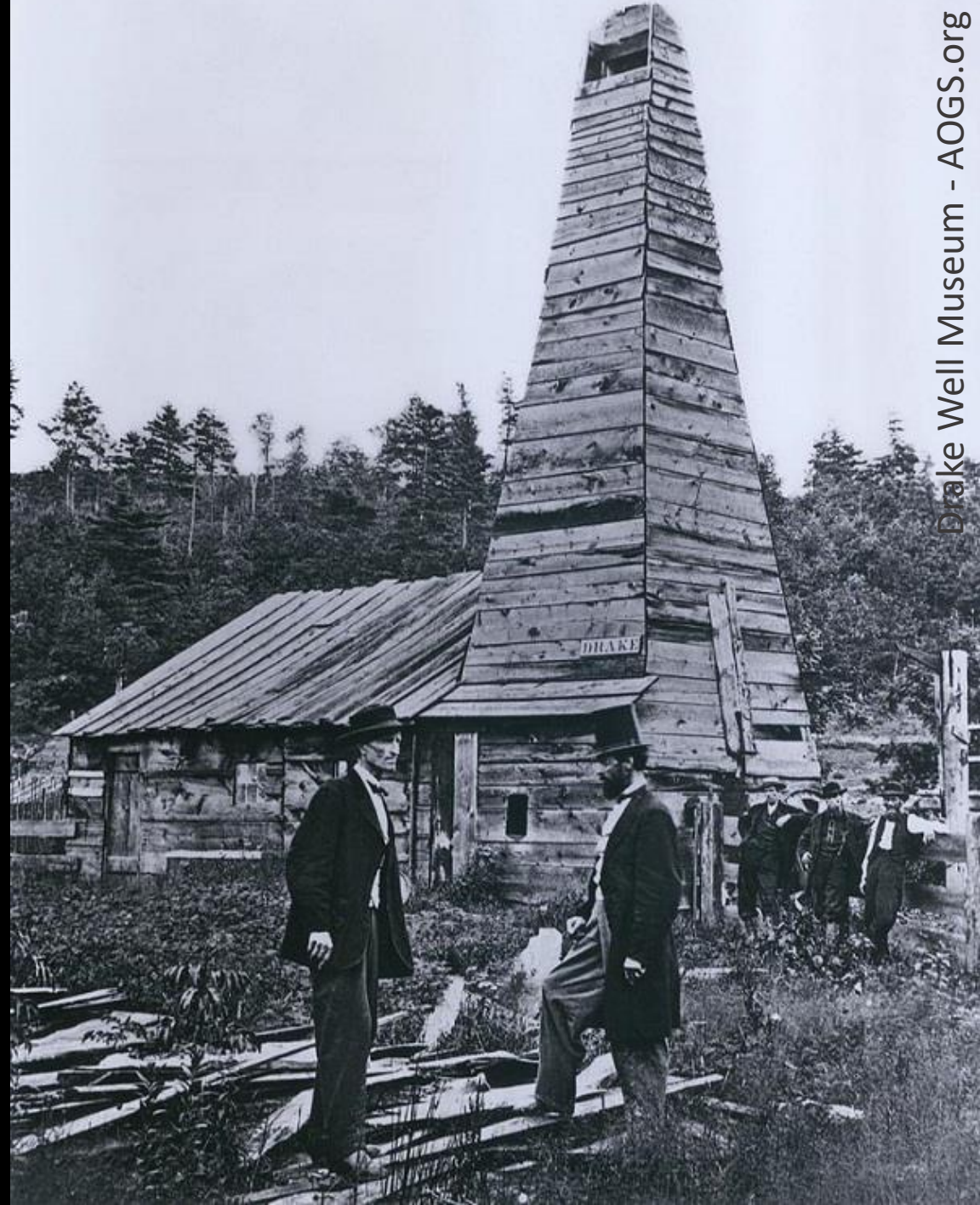




Production



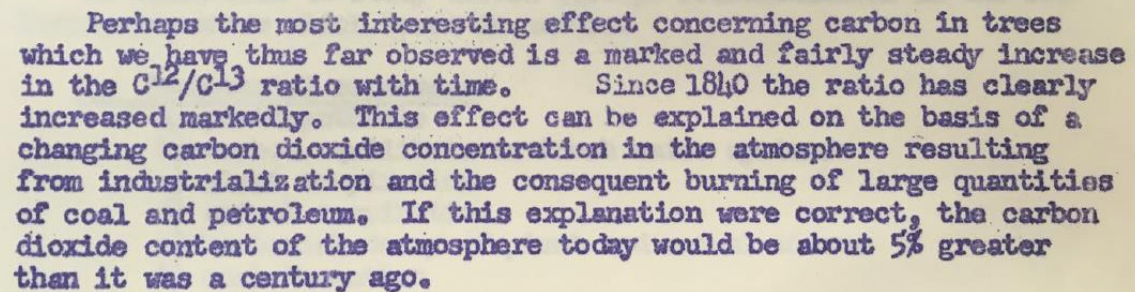




Drake Well Museum - AOGS.org

Early oil industry knowledge of CO₂ and global warming

To the Editor — In a seminal 1960 article in the journal *Tellus*, Charles Keeling reported that the concentration of atmospheric CO₂ at the South Pole was rising at a rate “nearly that to be expected from the [global] combustion of fossil fuel”¹. His measurements, begun in 1957, allowed him to start constructing the famous Keeling curve — the continuous, direct record of rising CO₂ levels around the globe caused primarily by the burning of fossil fuels. Yet archival documents show that even before Keeling published his measurements, oil industry leaders were aware that their products were causing CO₂ pollution to accumulate in the planet’s atmosphere in a potentially dangerous

A photograph of a typed document on aged, yellowish paper. The text is in a serif font and discusses the C12/C13 ratio in trees and its increase since 1840, linking it to industrialization and fossil fuel burning. The text is an excerpt from a 1954 research proposal to the American Petroleum Institute (API) by Harrison Brown and colleagues.

Perhaps the most interesting effect concerning carbon in trees which we have thus far observed is a marked and fairly steady increase in the C¹²/C¹³ ratio with time. Since 1840 the ratio has clearly increased markedly. This effect can be explained on the basis of a changing carbon dioxide concentration in the atmosphere resulting from industrialization and the consequent burning of large quantities of coal and petroleum. If this explanation were correct, the carbon dioxide content of the atmosphere today would be about 5% greater than it was a century ago.

Fig. 1 | Excerpt of research proposal to the API from Harrison Brown and colleagues in 1954. The proposal informed the API that fossil fuels had caused atmospheric CO₂ levels to rise by about 5% over the last 100 years. Image reproduced from ref. ², Caltech Archives.

Benjamin Franta

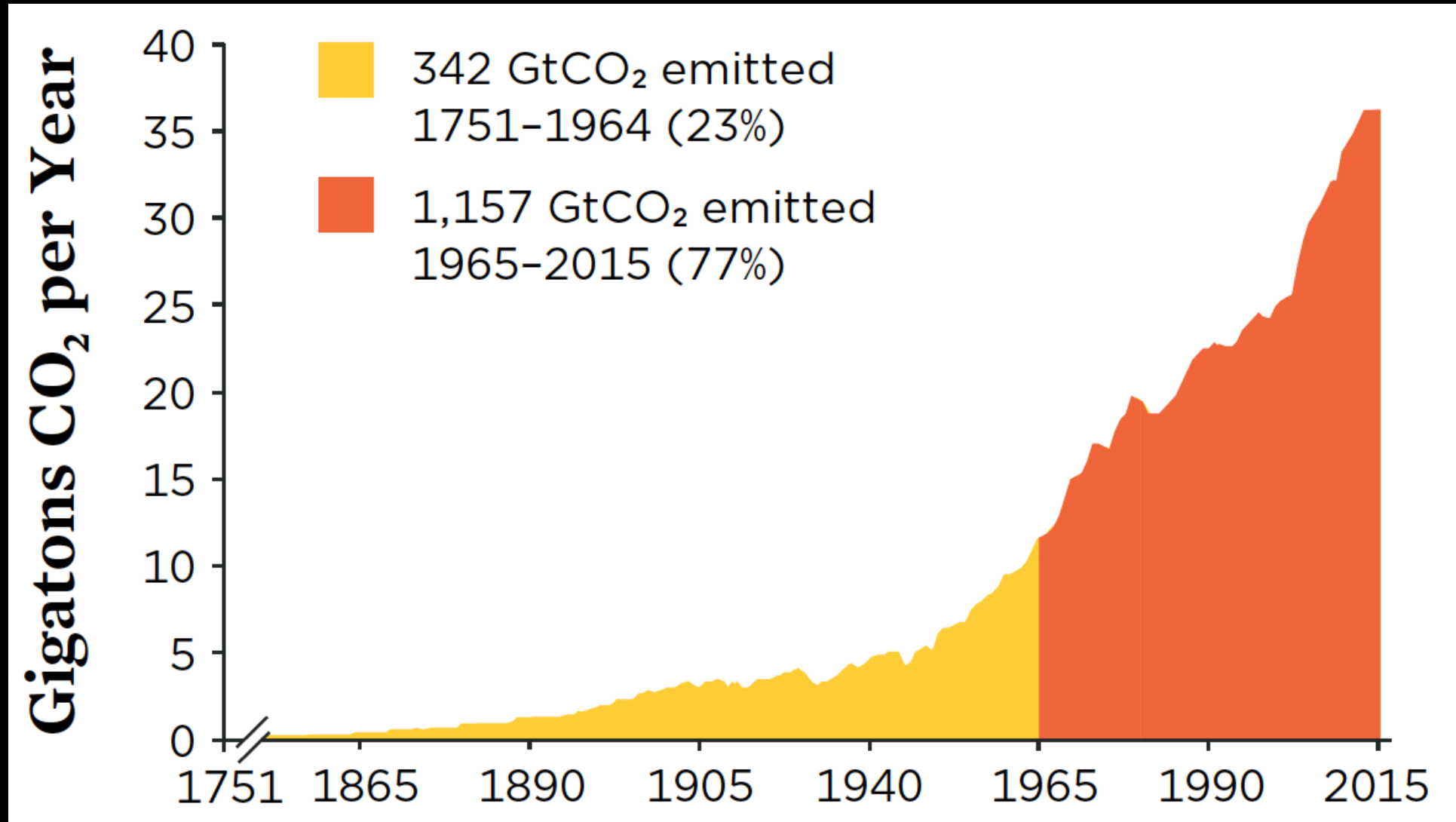
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Annual Global CO₂ Emissions from Fossil Fuel and Cement, 1751–2015



Data source: Boden, Marland, and Andres 2016; Image source: Union of Concerned Scientists

The rise in global atmospheric CO₂, surface temperature and sea level from emissions traced to major carbon producers



Source: NOAA

Ek Wurzel, Boneham, Dalton, Heede, Mera, Allen & Frumhoff. 2017
Climatic Change

bit.ly/GAT_SLR

Attributing ocean acidification to major carbon producers



Licker, Ekwurzel, Doney Cooley, Lima, Heede and Frumhoff, 2019

Environmental Research Letters

http://bit.ly/OA_CO2



1880-2015
emissions tied to
88 largest carbon
producers
contributed
59-60% of
Atmospheric CO₂
rise

Ekwurzel et al., 2017, Climatic Change
Licker et al., 2019, Environmental Research Letters

bit.ly/GAT_SLR

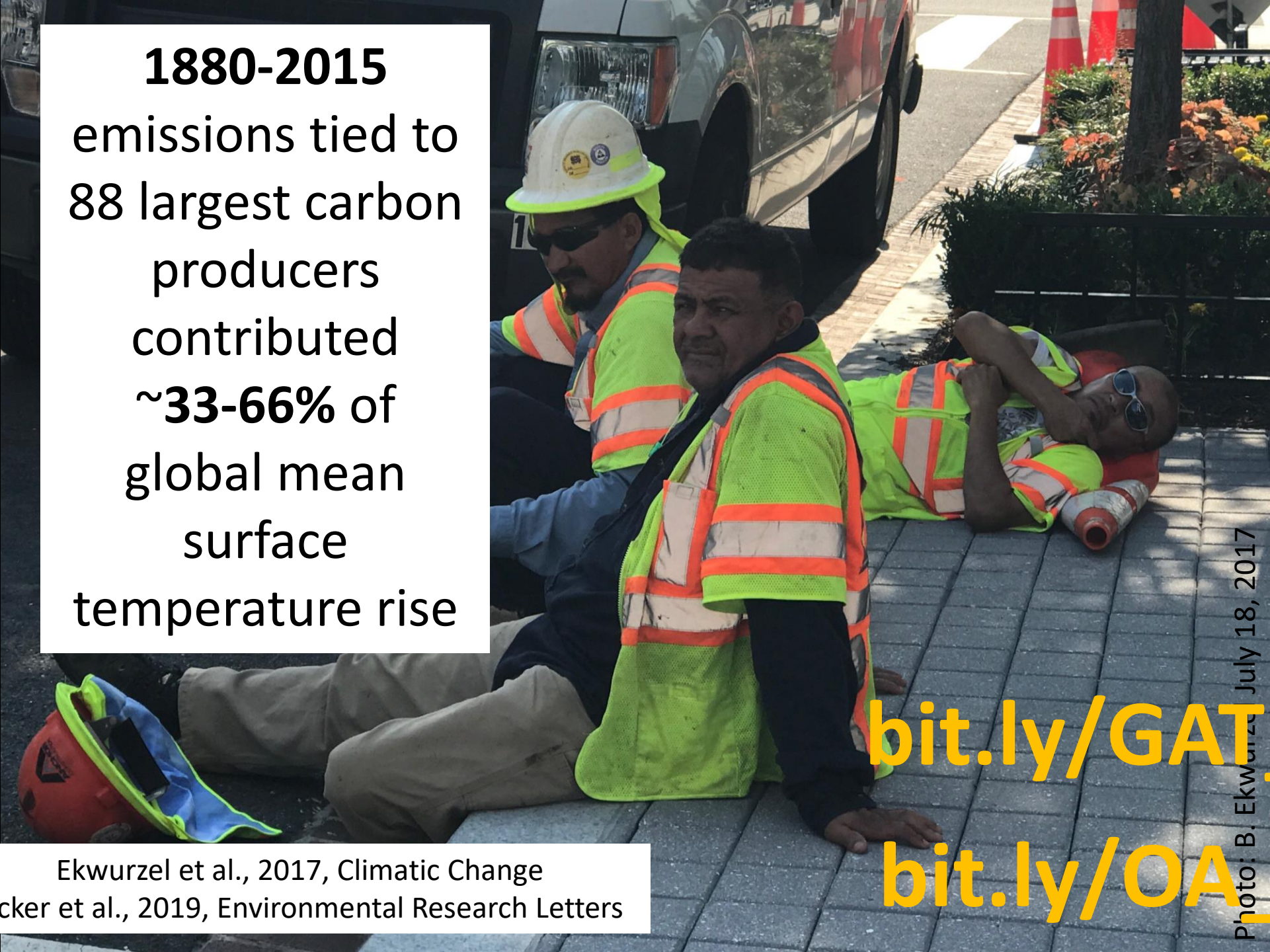
bit.ly/OA_CO2

1880-2015
emissions tied to
88 largest carbon
producers
contributed
~**33-66%** of
global mean
surface
temperature rise

Ekwurzel et al., 2017, Climatic Change
Licker et al., 2019, Environmental Research Letters

bit.ly/GAT_SLR
bit.ly/OA_CO2

Photo: B. Ekwurzel July 18, 2017



1880-2015
emissions tied to
88 largest carbon
producers
contributed
~**20-51%** of
global sea level
rise

Source: NOAA



bit.ly/GAT_SLR

bit.ly/OA_CO2

Ekwurzel et al., 2017, Climatic Change
Licker et al., 2019, Environmental Research Letters

{ Who pays for damages and
adaptation? }



A fire hydrant nearly covered with sand washed ashore is seen in the aftermath of Hurricane Sandy in Atlantic City, New Jersey, October 30, 2012.
REUTERS/Tom Mihalek