

CLIMATE CHANGE DRIVERS AND IMPACTS ON ENVIRONMENT

Dr. Albert Chung, PhD, PE
achung@keramida.com
KERAMIDA Inc.
www.keramida.com

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Background – Who We Are

- KERAMIDA Inc. is a certified woman-owned environmental engineering and consulting firm established in 1998
- The firm employs over 100 technical experts and support personnel in offices throughout the U.S., including Indianapolis, IN; Granger, IN; Chicago, IL; Pittsburgh, PA; New York, NY; Los Angeles, CA, and Sacramento, CA.
- Over 20 years of expertise in sustainability and climate change consulting.
- Accredited Lead GHG Verifier in the state of California

What is the Scientific Community Saying?

Quotes from Science Community

“Warming of the climate system is unequivocal”

-Intergovernmental Panel on Climate Change

“It is extremely likely that human activities, especially emissions of greenhouse gases, are the dominant cause of the observed warming”

-U.S. Global Change Program

“The scientific understanding of climate change is now sufficiently clear to begin taking steps to prepare for climate change”

-U.S. National Academy of Sciences

“The Earth’s climate is changing in response to increasing concentration of greenhouse gases and particulate matter in the atmosphere, largely as a result of human activities”

-American Chemical Society

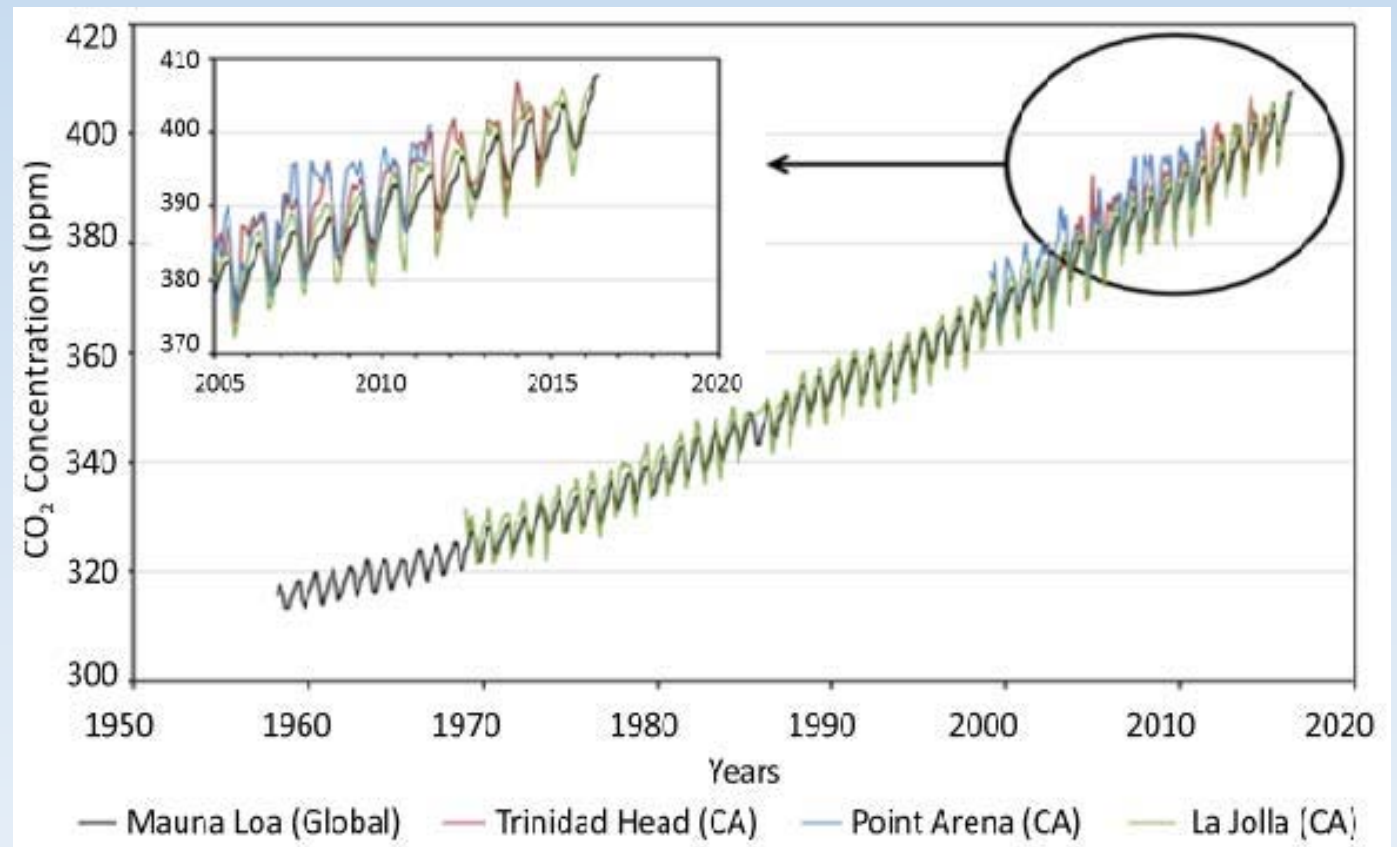
Outline

- Climate Change Drivers
- Changes in Climate
- Impacts of Climate Change on Physical Systems
- Profile of Anthropogenic GHG Emissions
- Impacts of Climate Change on Legislation and Litigation

Climate Change Drivers

Rising Atmospheric CO₂ Concentrations

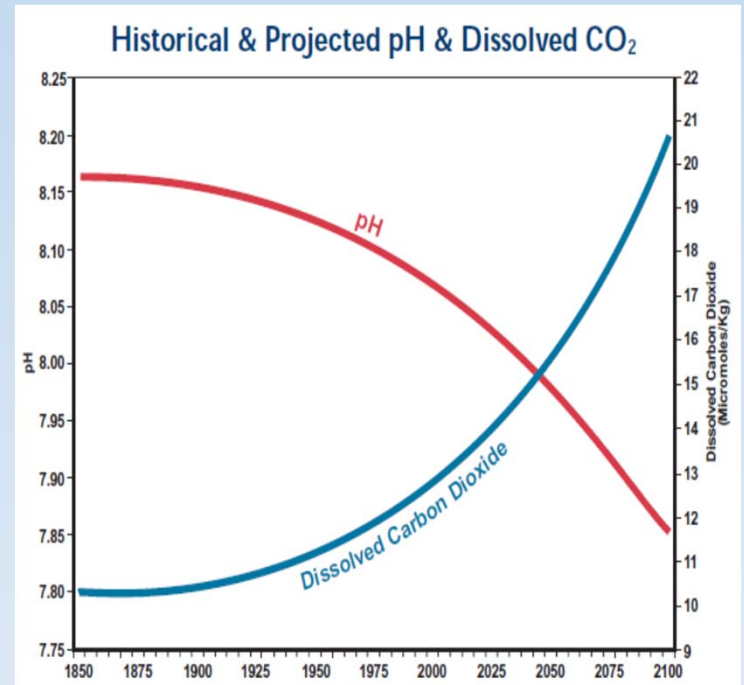
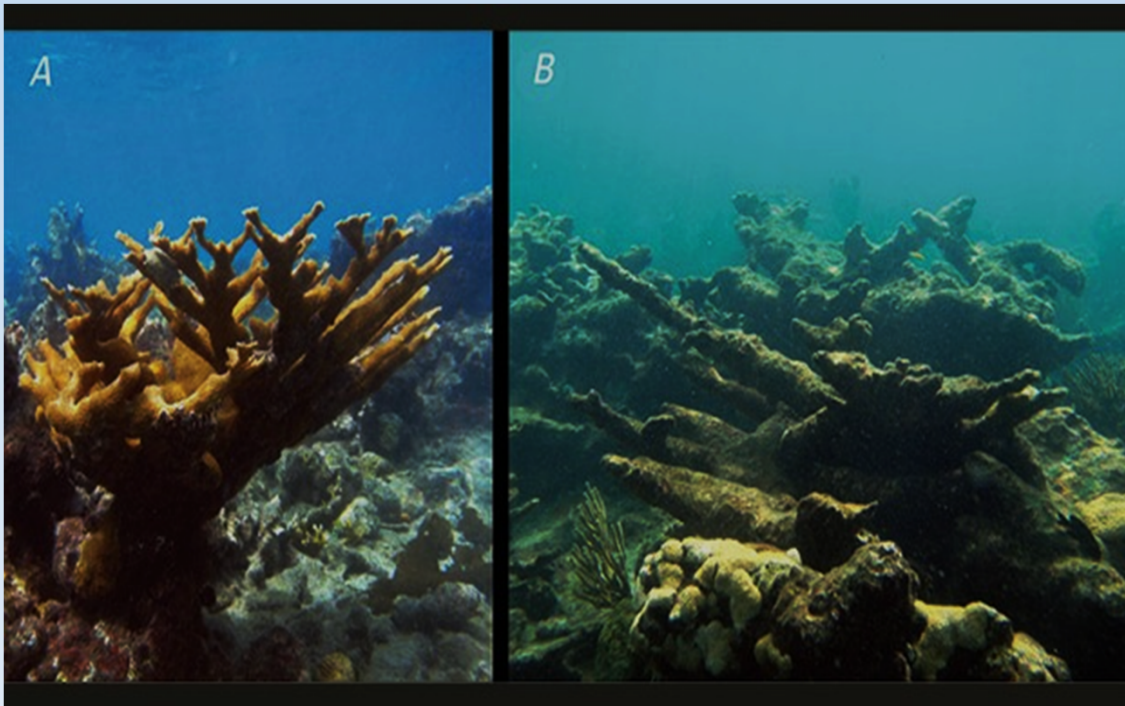
Atmospheric CO₂ Increasing at a rate of ~ 2 ppm/yr



Rising Atmospheric CO₂ Concentrations

- CO₂ makes up 60-80% of the anthropogenic GHG emissions
- **Literature has indicated that the atmospheric lifetime of CO₂ can be up to 200 years**
- Sinks of CO₂ include land and ocean uptake
- Views vary on dynamics of CO₂ in the environment,
 - Accumulation of CO₂ in the atmosphere outpacing uptake rate from land and ocean sinks.
 - Some consider that CO₂ do not have reservoirs and sinks but rather equilibrates among the atmosphere, ocean, and biosphere.

Acidification of Oceans

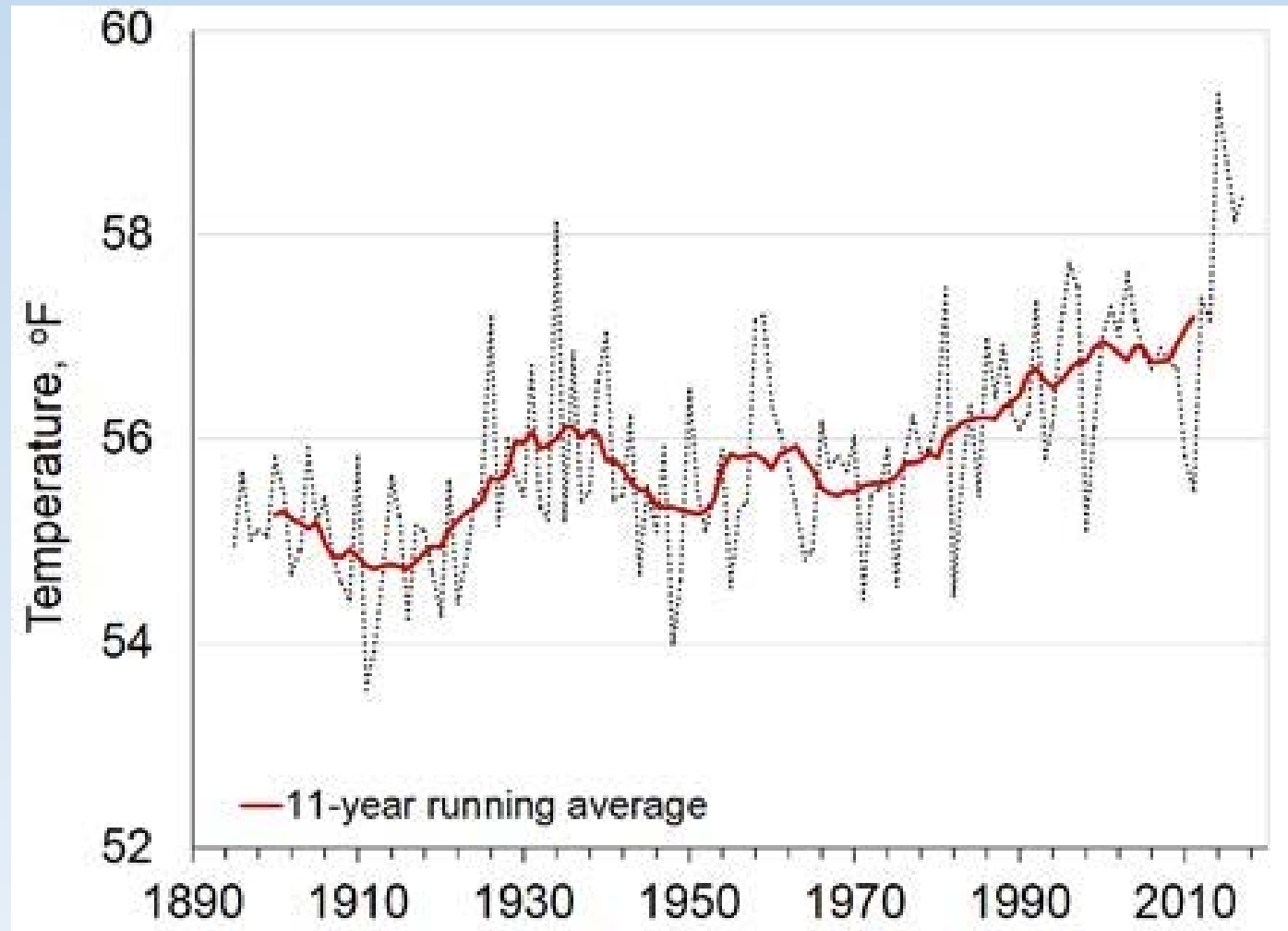


- As dissolved CO₂ increases the pH of the ocean decreases or gets more acidic
- Decline in pH has consequences on organisms that rely on calcium carbonate for shells and skeletons

Changes in Climate

Rising Temperatures

Average annual temperature on the rise in California



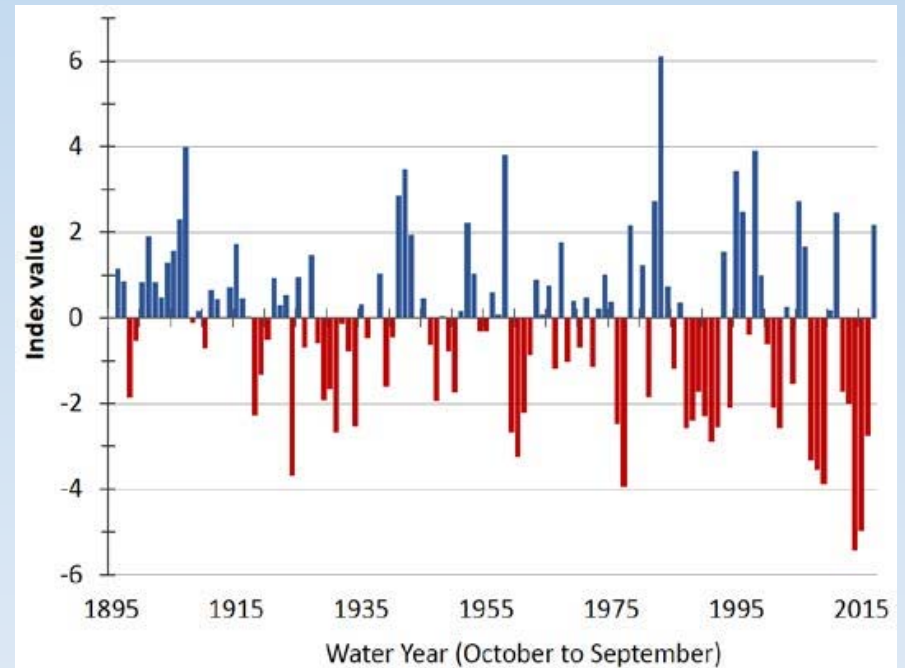
Rising Temperatures

- Atmospheric CO₂ concentration of 400 ppm is predicted to increase temperatures from 2-7 degrees Fahrenheit.
- Atmospheric CO₂ concentration of 500 ppm is predicted to increase temperatures from 4-9 degrees Fahrenheit.

Increased Drought

Intensity and frequency of drought conditions increasing in California (Palmer Drought Severity Index)

Image – Lake Oroville (N. California)



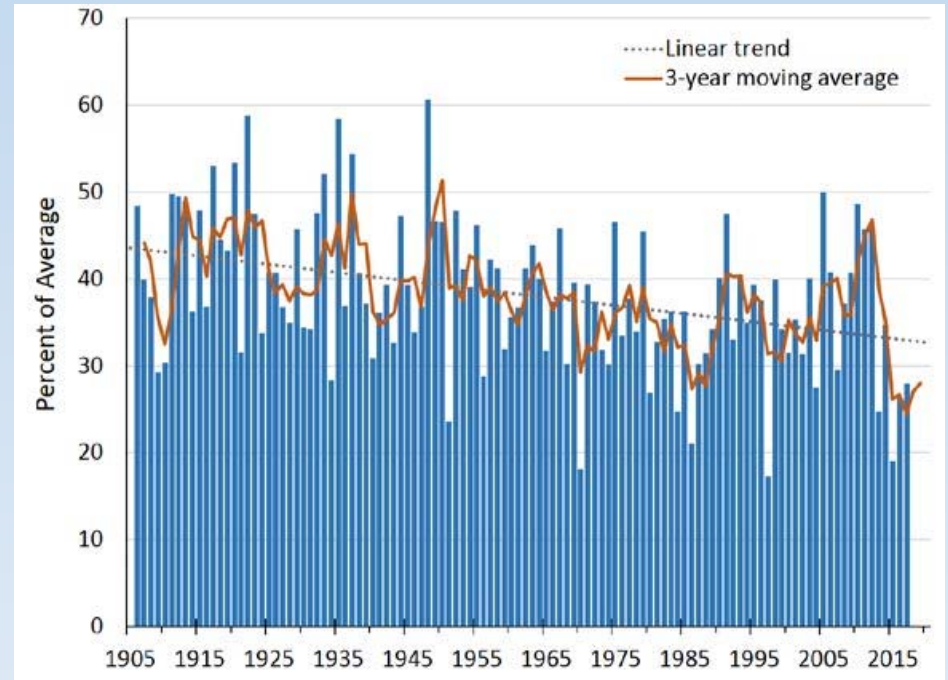
Impacts of Climate Change on Physical Systems

Decline in Spring Runoff

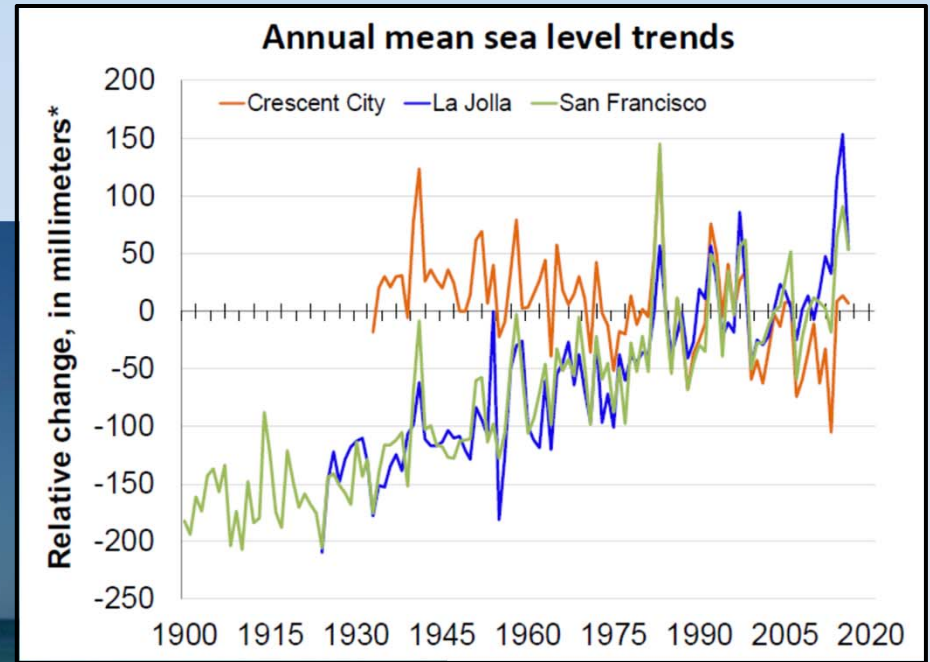
Spring runoff to rivers in decline across the state.

Chart – Sacramento River

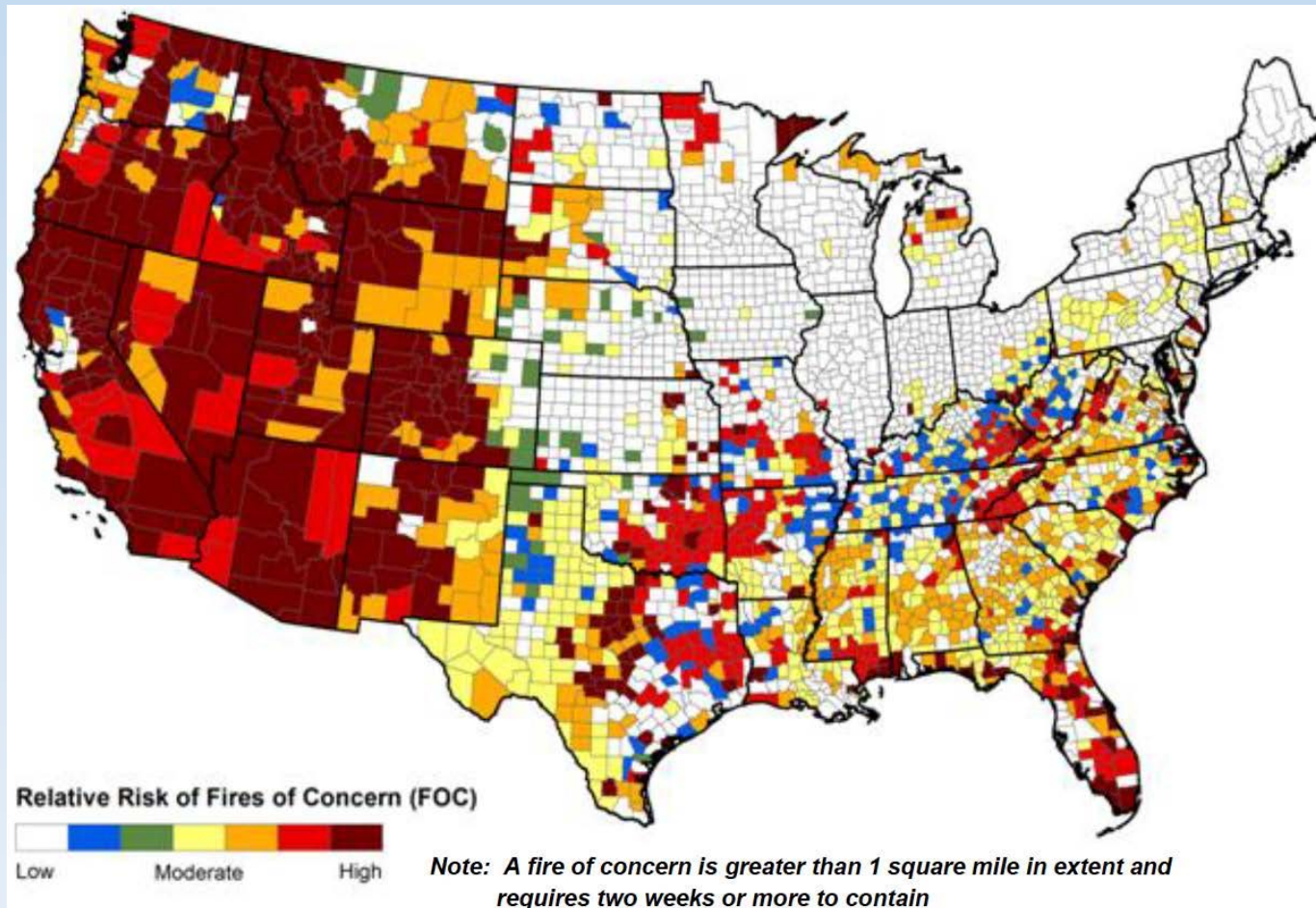
Image – Tuolumne River (Yosemite)



Rising Sea Level

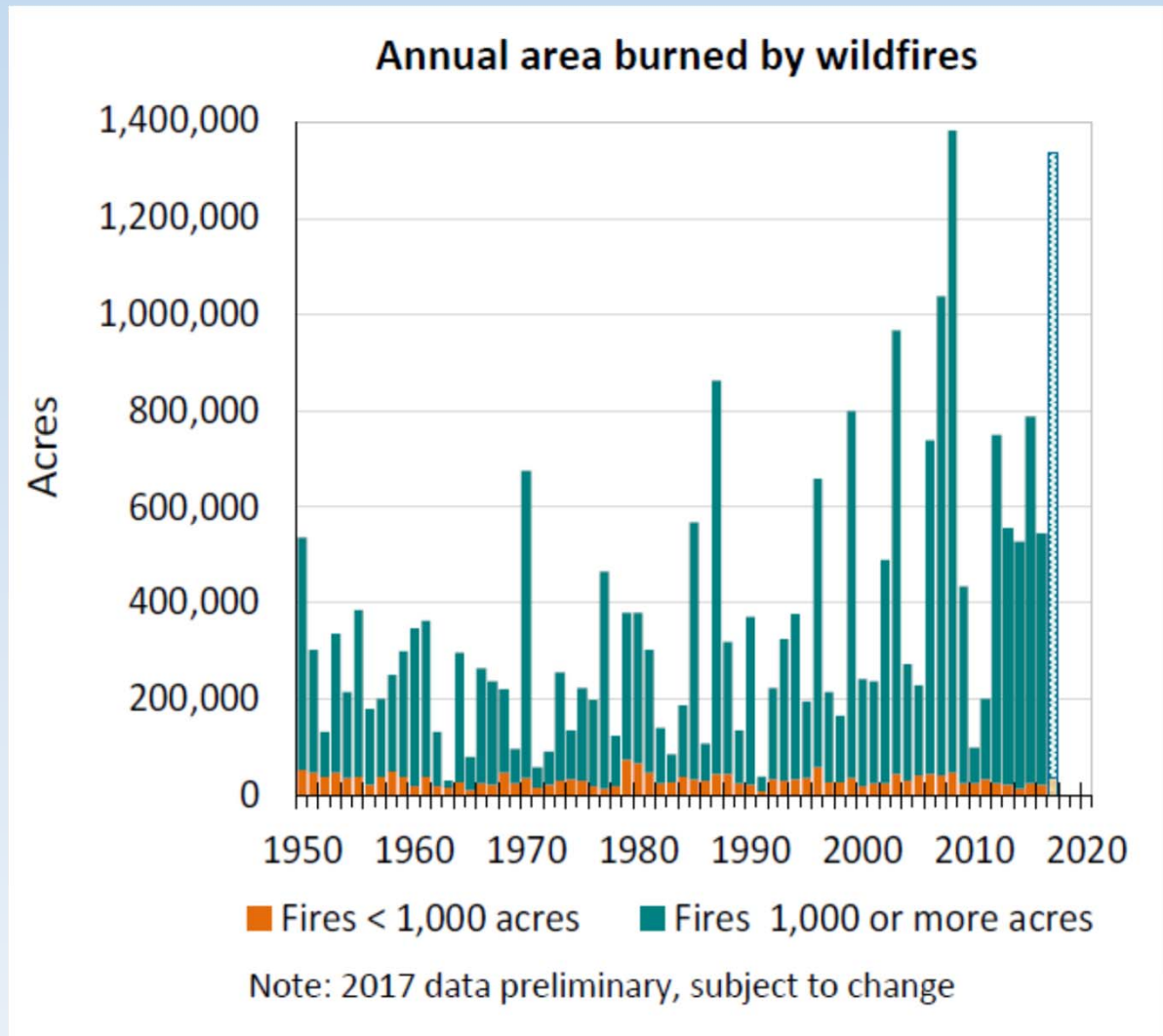


Impact of Wildfires



Impact of Wildfires

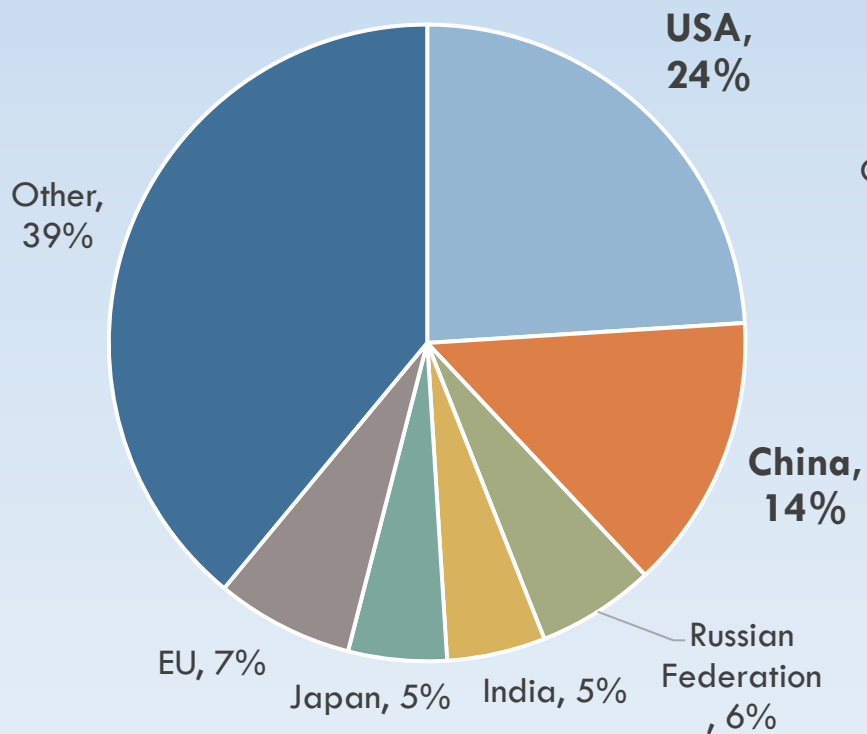
Large wildfires generally increasing in California.



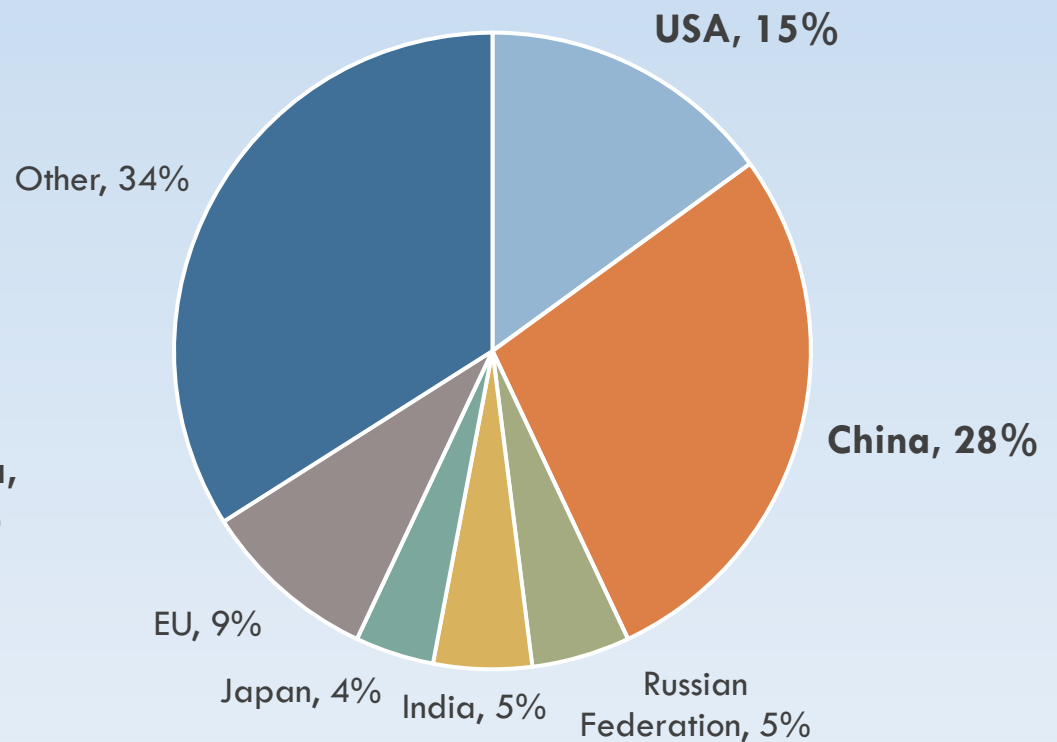
Profile of Anthropogenic GHG Emissions

Global CO₂ Emissions, 2002 and 2016

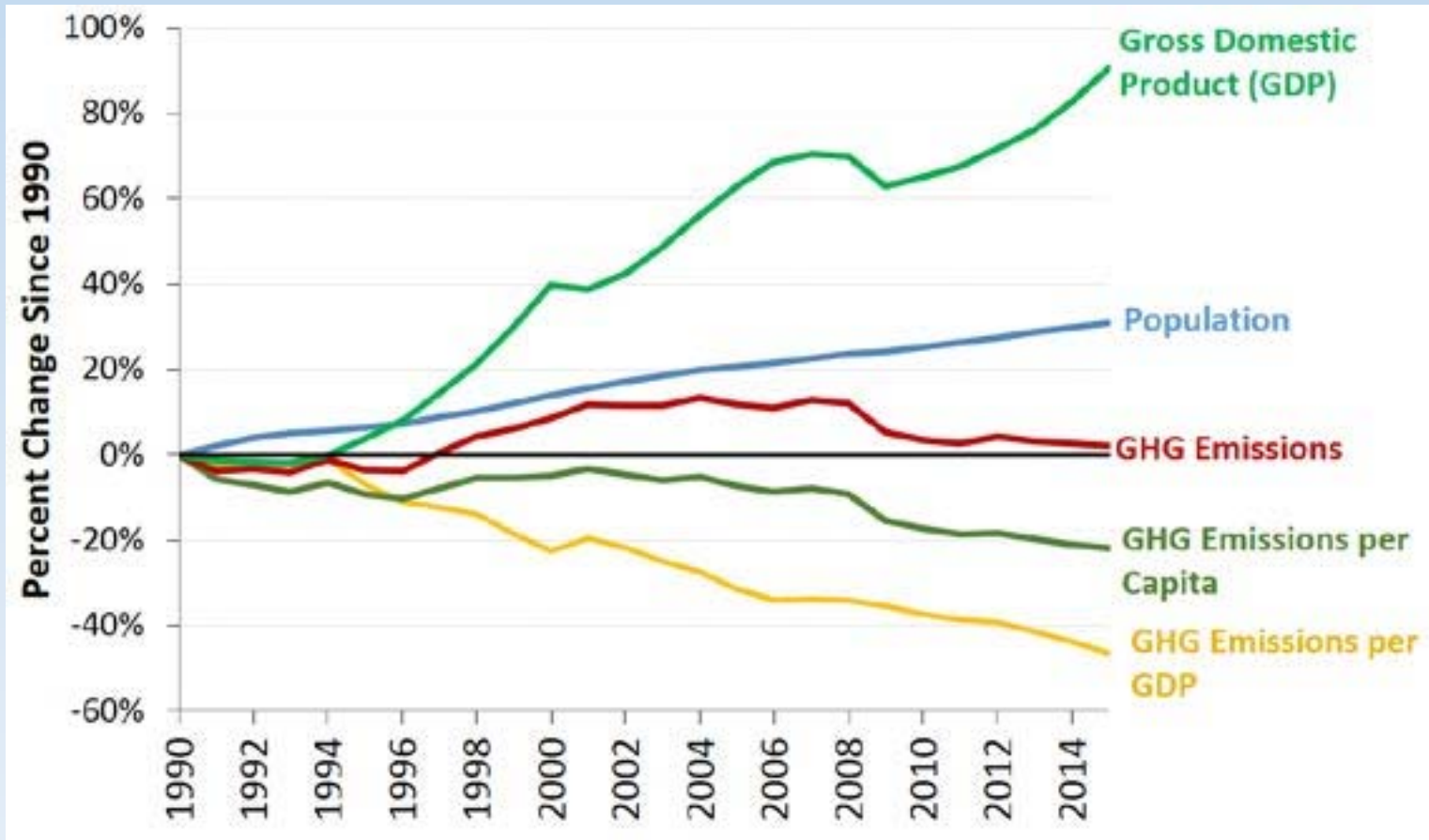
Global CO₂ Emissions ~ 25 million MT



Global CO₂ Emissions ~ 32 million MT



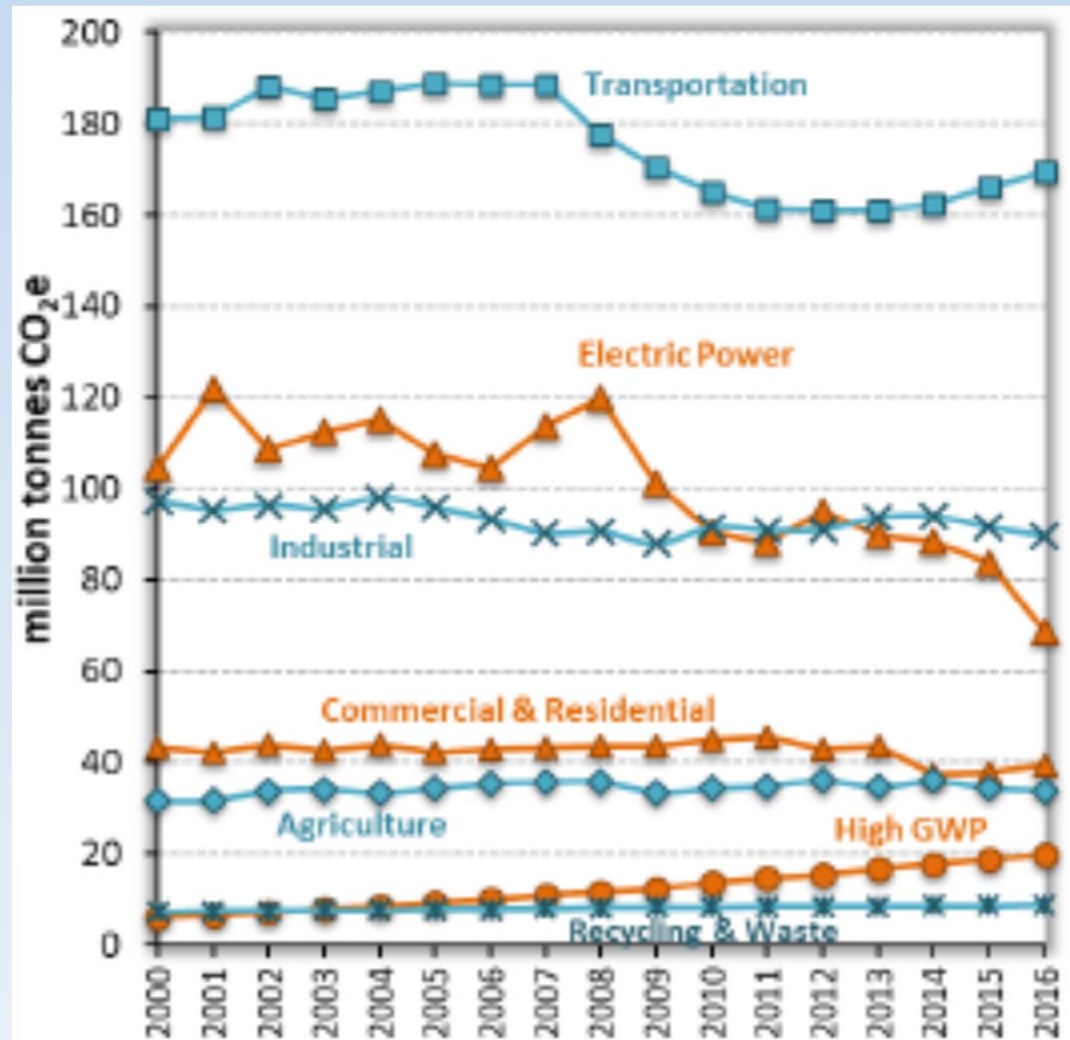
GHG Emissions, California



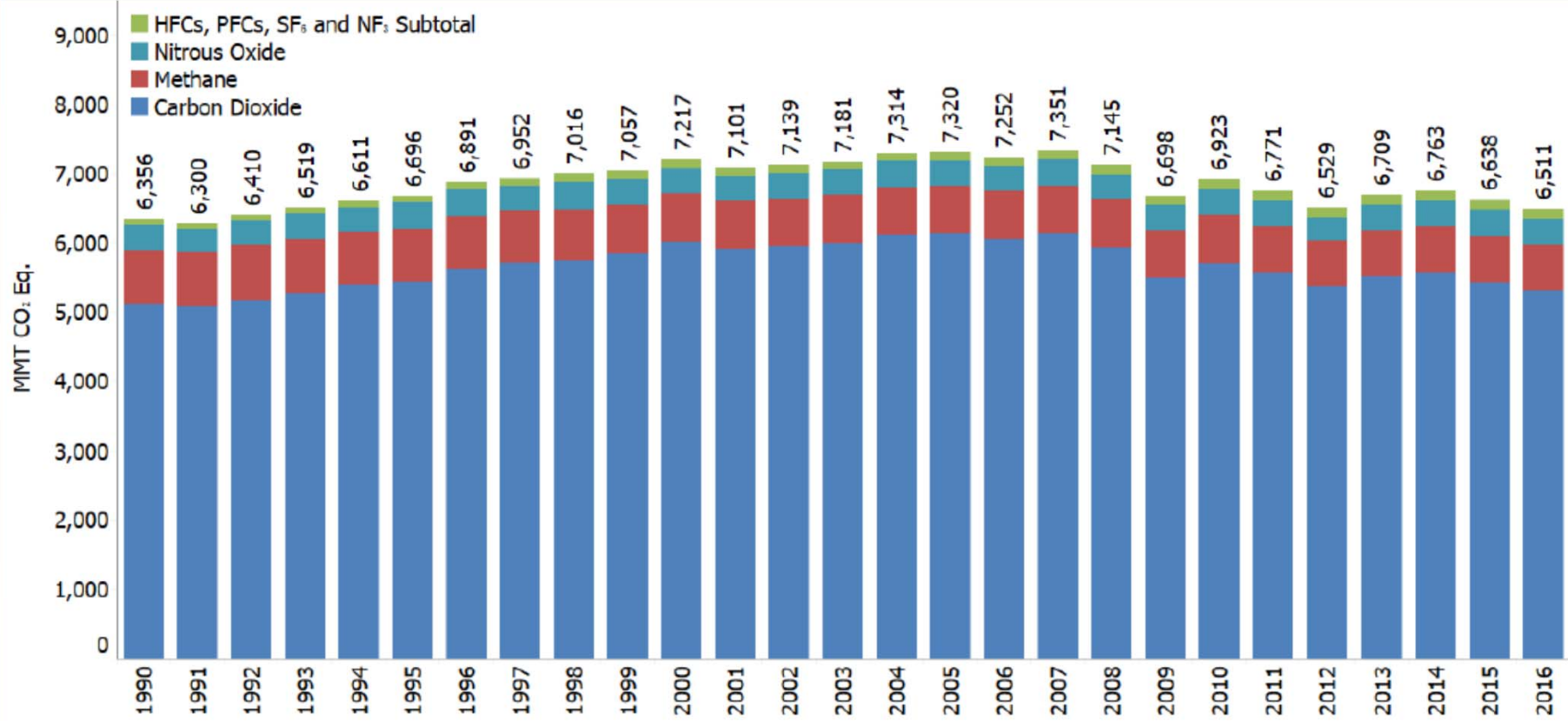
GHG Emissions, California

Breakdown of GHG Emissions By Industry, California

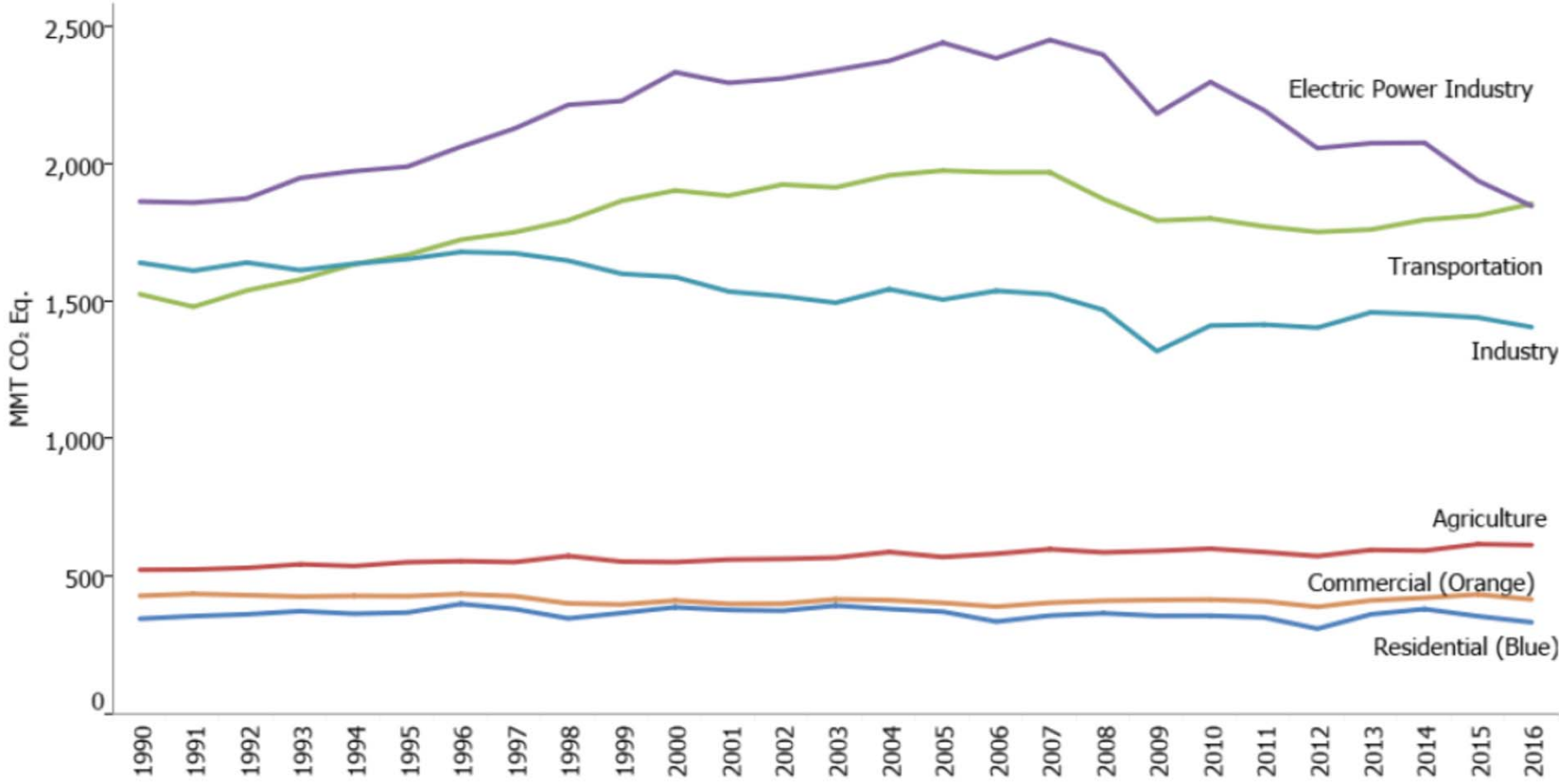
430 MMT CO₂e ~ 6% US
Population ~12%



GHG Emissions, United States

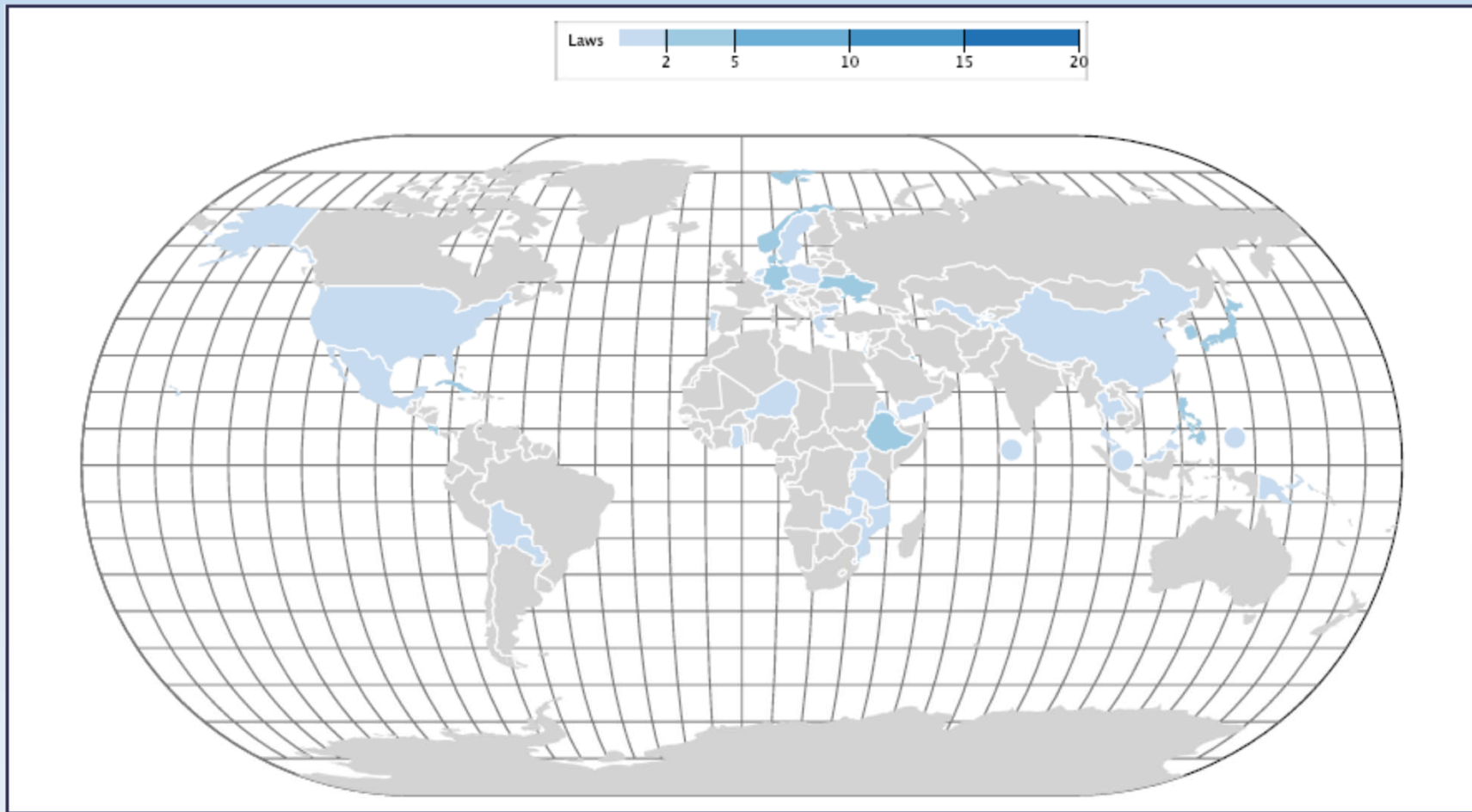


GHG Emissions, United States

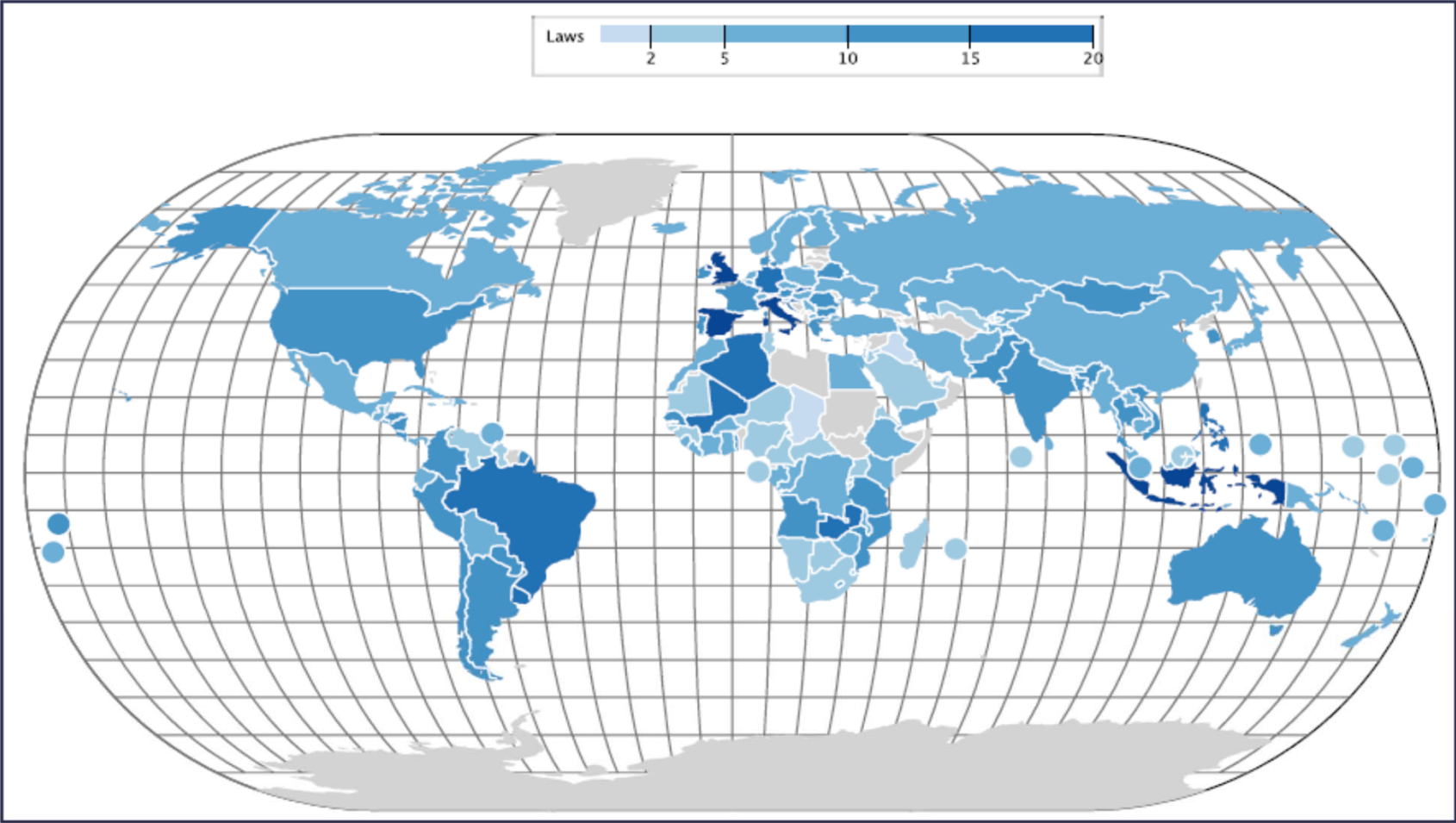


Impacts of Climate Change on Legislation and Litigation

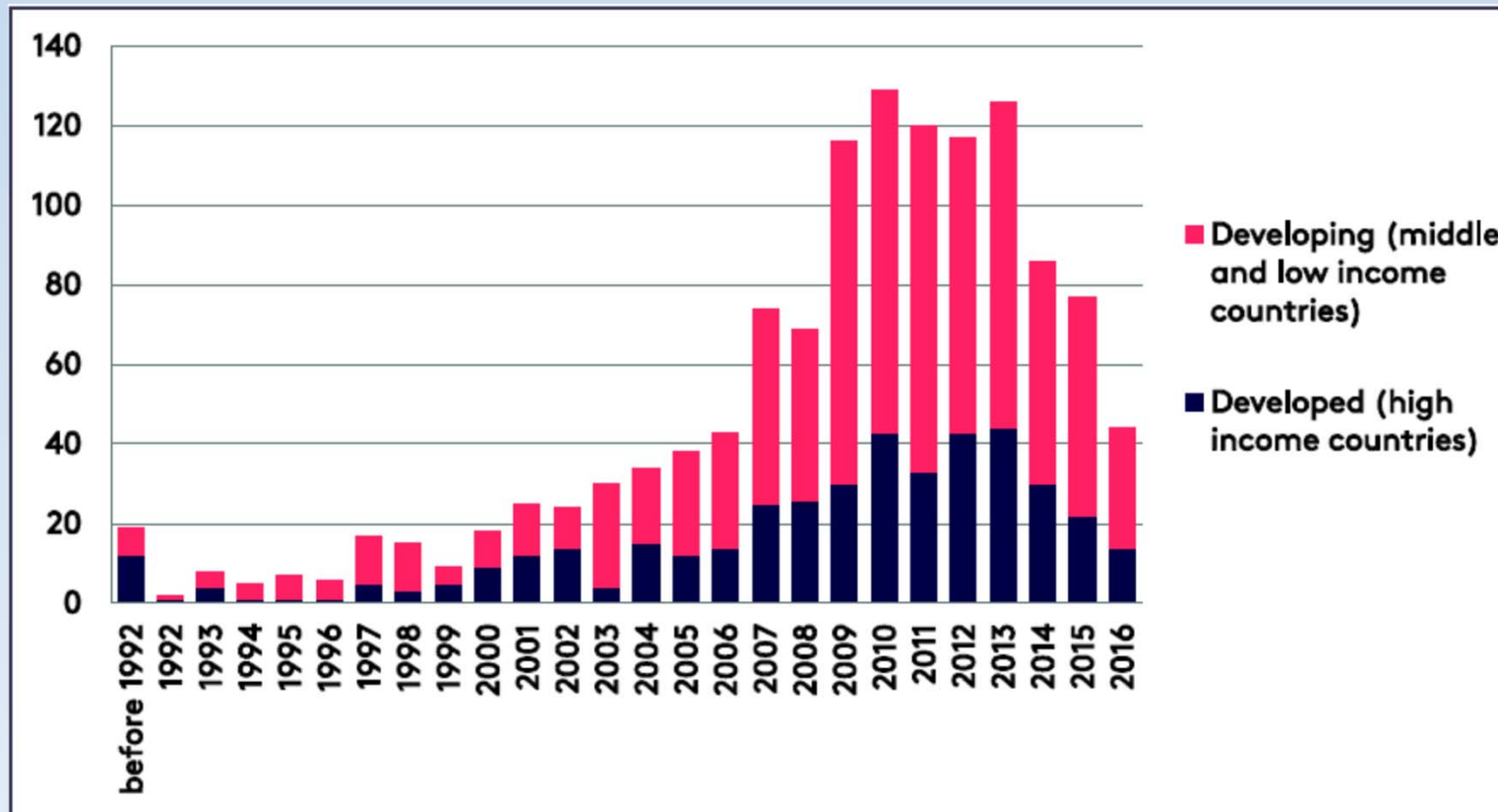
Climate Change Legislation - 1997



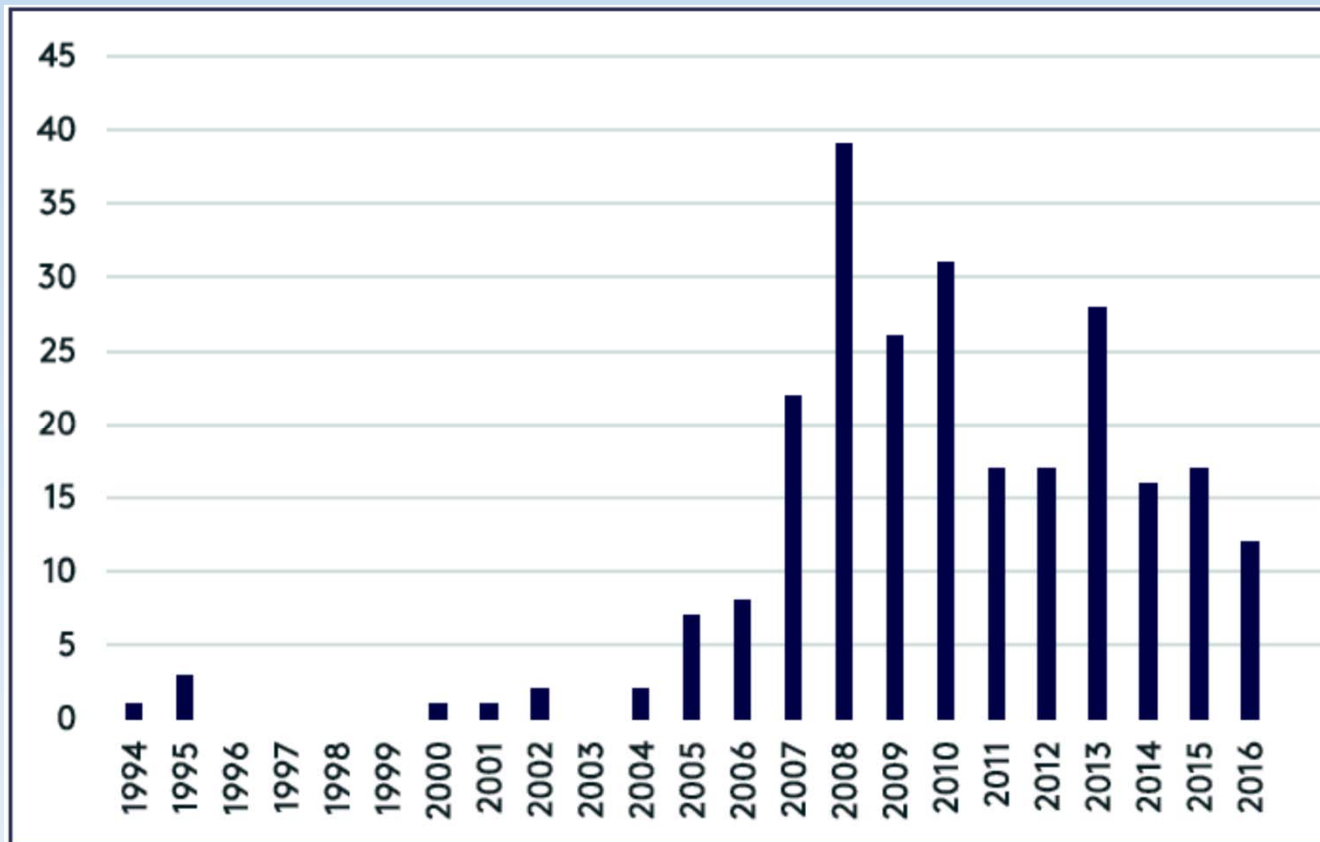
Climate Change Legislation - 2017



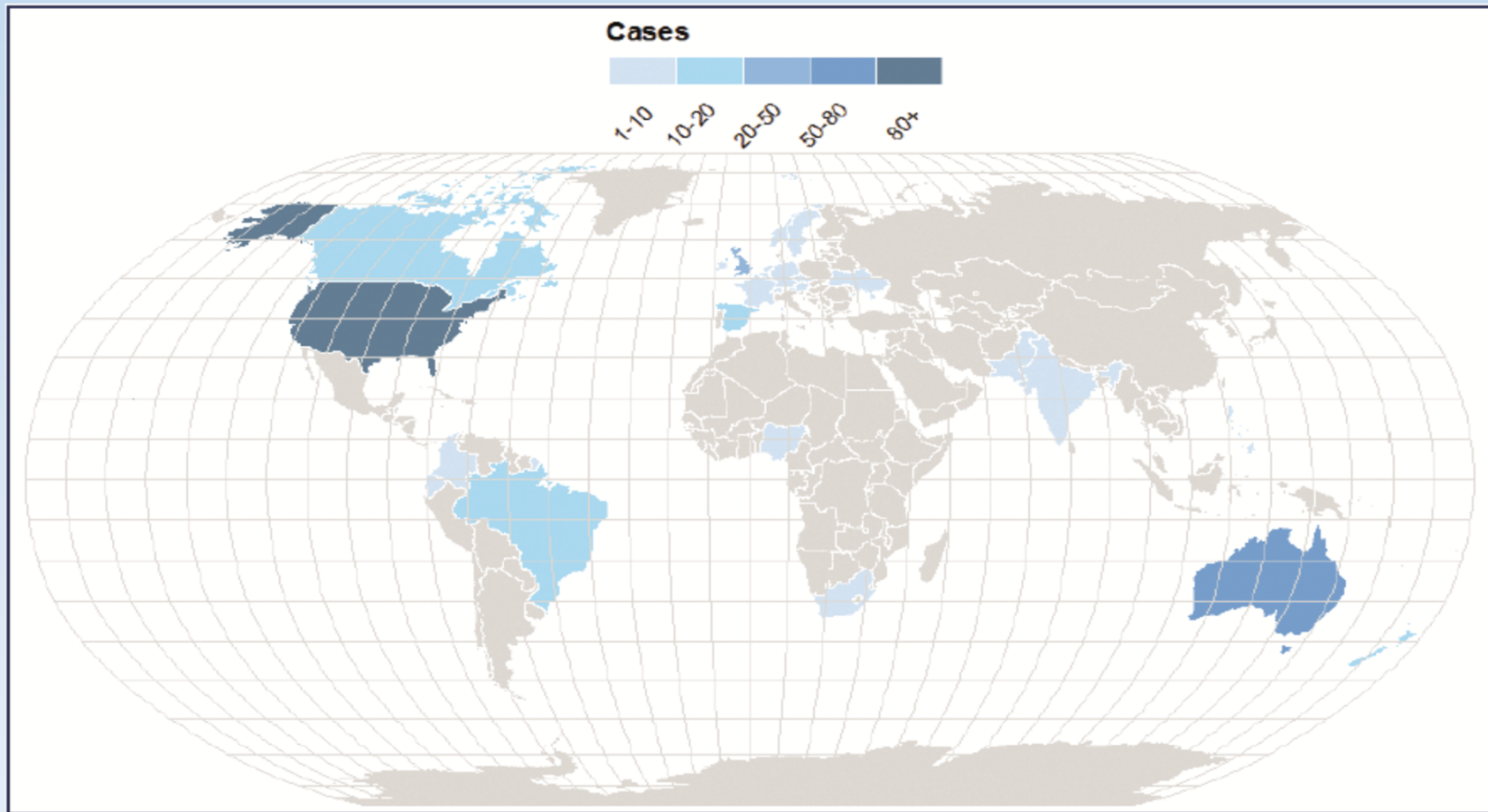
Climate Change Legislation in 2017



Global Litigation Cases (Not Including United States)

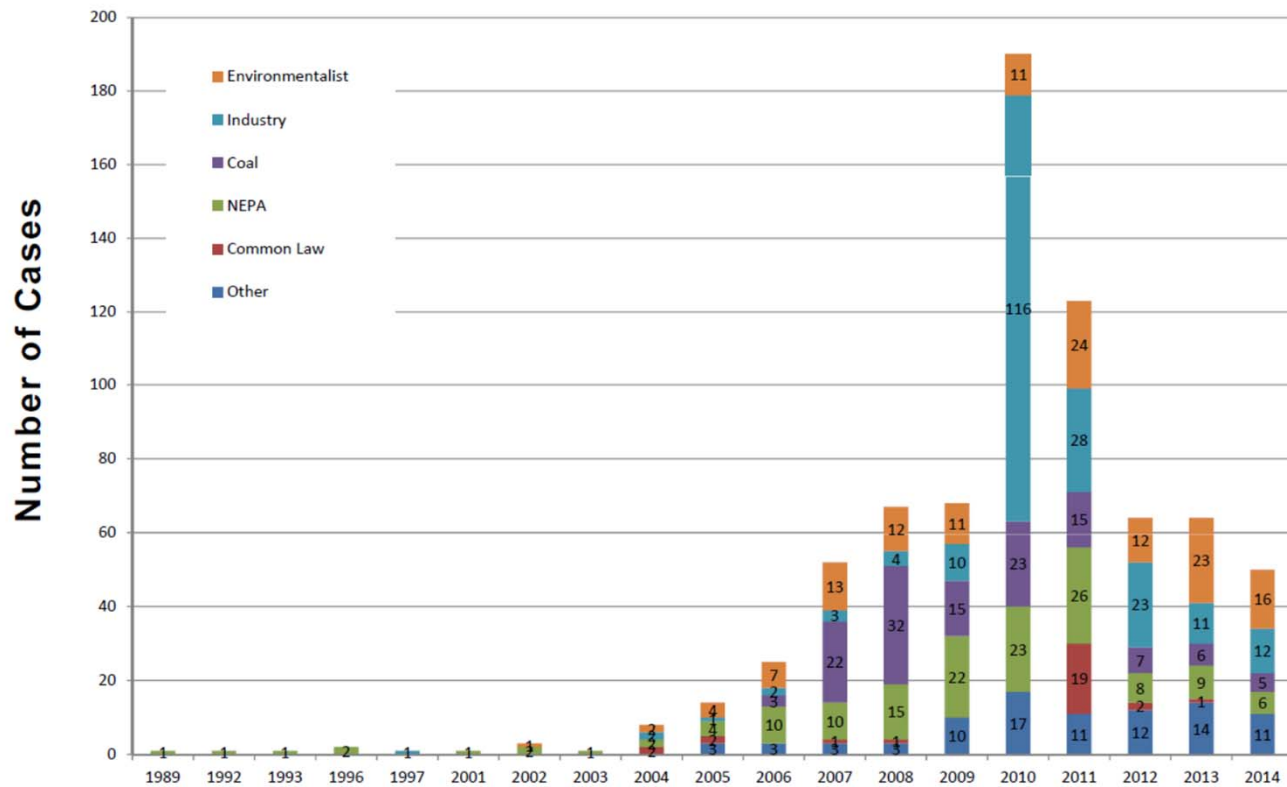


Litigation Cases Globally, 1994-2017

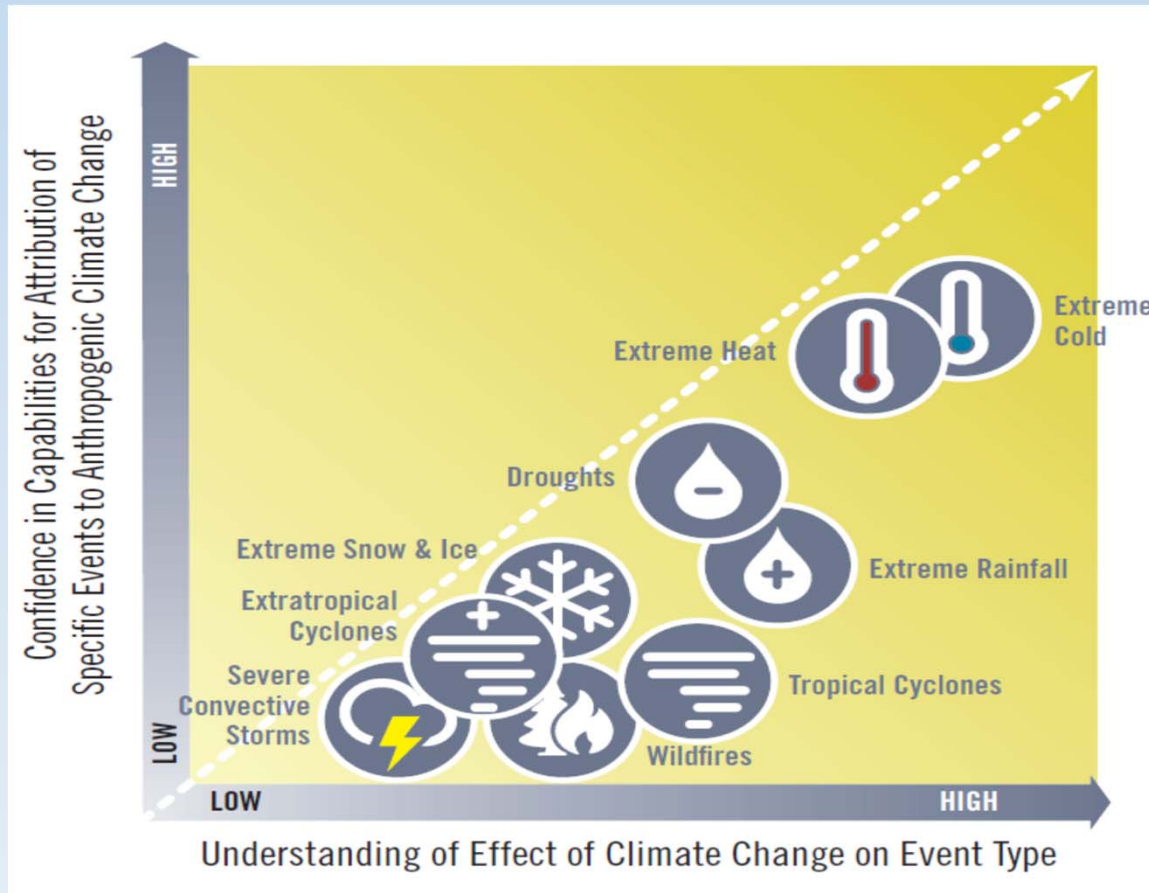


Litigation Cases, United States

Climate Litigation: Filings



Climate Change Effects Relation to Anthropogenic Emissions



Reference: National Academies of Science, Engineering and Medicine (NASEM) Attribution of Extreme Weather Events in the Context of Climate Change

Thank you!